

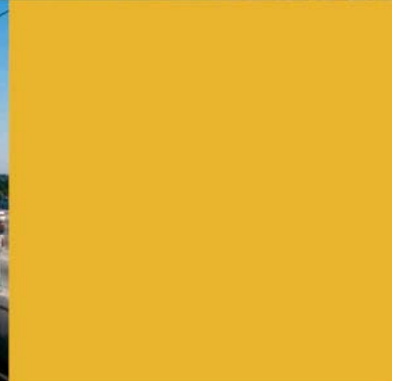
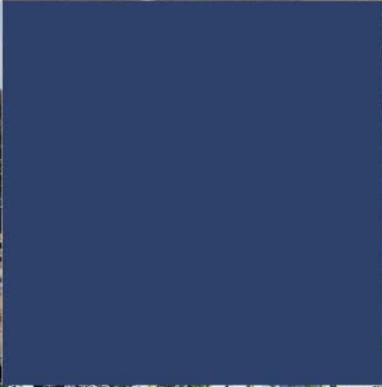
PACIFIC ELECTRIC RIGHT-OF-WAY/WEST SANTA ANA BRANCH CORRIDOR ALTERNATIVES ANALYSIS

Task 4.2 – Initial Screening Report

Final – July 6, 2011



WEST SANTA ANA BRANCH



SOUTHERN CALIFORNIA



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1.0 INTRODUCTION

The Southern California Association of Governments (SCAG), in coordination with the Los Angeles County Metropolitan Transportation Authority (Metro) and the Orange County Transportation Authority (OCTA), has initiated an Alternatives Analysis (AA) study to explore opportunities for connecting Los Angeles and Orange Counties through the reuse of the Pacific Electric Right-of-Way/West Santa Ana Branch Corridor (PEROW/WSAB Corridor) as shown in Figure 1.1. The AA study process also will evaluate possible connections from the PEROW/WSAB Corridor north to the Metro Green Line and Union Station in Downtown Los Angeles, and south to the Santa Ana Regional Transportation Center in Downtown Santa Ana.

The PEROW/WSAB Corridor AA process will follow the Federal Transit Administration (FTA) guidelines and standards to not only provide a reasoned basis for the selection of the Recommended Alternative, but also to ensure that the identified transportation alternative is eligible for future federal funding. The AA study efforts will identify and assess a full range of transportation alternatives, and recommend a preferred alternative, or alternatives for further study, that addresses corridor mobility needs in the year 2035 and beyond, while being sensitive to community and environmental concerns.

1.1 Alternatives Analysis Study Process

The AA planning process focuses on a specific set of transportation needs in a given corridor, identifies alternative actions to address those needs, and generates the information required to select a preferred project for implementation. These activities address such issues as costs, benefits, environmental, and community impacts, and financial feasibility. The AA study is a locally managed process that relies to a large extent on the information on regional travel patterns, problems, and needs generated as part of the regional and metropolitan transportation planning process, and specifically for the study corridor. The first step in the AA study process is development and documentation of information and analyses providing a basic understanding of the Corridor Study Area, and the specific transportation problems and needs to be addressed.

1.1.1 Mobility Problem and Purpose and Need Statement

The PEROW/WSAB Corridor Study Area is a densely developed area covering the most active hearts of Los Angeles and Orange counties. This study area includes the most densely populated areas of both counties, including Downtown Los Angeles, South Los Angeles, the Gateway Cities subregion, and West Orange County (Santa Ana, Garden Grove, Stanton, and Cypress) area. Current population density is two and five times the Orange and urbanized Los Angeles County averages, respectively, and is projected to increase by 12 percent by 2035. Now and in the future, the Corridor Study Area will contain some of the region's densest employment centers ranging from major office development centers to concentrations of industrial, manufacturing, and intermodal facilities. In 2035, the Corridor Study Area will contain 44 percent of Orange County's total employment, and 29 percent of Los Angeles County's total jobs.

Given the high number of employment destinations in the Corridor Study Area, the most frequent trip purpose is weekday travel to work. This trip type occurs within a limited window of time (morning and evening peak periods) and results in significant congestion on a majority of the corridor's freeway and highway system. In addition, the study area contains a wide variety of educational, retail, cultural,

entertainment, and recreational destinations, many of which attract peak and non-peak trips from throughout Los Angeles and Orange counties, and beyond.

As documented in the *PEROW/WSAB Corridor AA Purpose and Need Report*, the corridor's Mobility Problem can be described in terms of:

- **Transit system constraints** – The study area lacks transit system connections both within the corridor, and beyond the corridor to the regional transit system.
- **Freeway and arterial congestion** – The freeway system serving the corridor is currently highly congested resulting in travel time delays for a significant portion of each day. Correspondingly, a large percentage of the study area's major arterial intersections currently operate at- or beyond-capacity during both peak travel periods.
- **Limited transportation system options** – The corridor currently has limited travel options available to residents, with a corridor average of 86 percent of daily work trips made by automobile.

The Purpose and Need Statement identified that by the year 2035, the magnitude and nature of the corridor's forecast population and employment growth trends are projected to result in continuing transportation challenges as evidenced by the following:

- Significant forecast growth in daily trips.
- Continuing high level of single occupancy vehicle (SOV) travel due to limited travel options.
- Growing need to add travel capacity without negatively impacting the environment.
- Lack of direct connections to the regional transit system.
- Lack of connections to the corridor's destinations and activity centers.
- Growing transit needs due to increasing low-income and aging populations.

1.1.2 Mobility Needs

Identification of an appropriate set of alternatives for the corridor should be in response to the identified Mobility Problem. As presented in the *PEROW/WSAB Corridor AA Purpose and Need Report*, the Corridor Study Area is a densely developed area covering the most active hearts of Los Angeles and Orange counties, including Downtown Los Angeles, South Los Angeles, the Gateway Cities subregion, West Orange County (Santa Ana, Garden Grove, Stanton, and Cypress) area, and Downtown Santa Ana. Future population is projected to increase by 12 percent, or by 500,000 residents, and the Corridor Study Area will contain 44 percent of Orange County's total employment, and 29 percent of Los Angeles County's total jobs. Given the high number of employment and activity centers in the Corridor Study Area, there will be a complex set of mobility needs including the following:

- Commuters accessing major office employment areas, and industrial, manufacturing, and intermodal facilities;
- Students, teachers, and employees traveling to public and private educational institutions;
- Shoppers traveling to the corridor's main street retail districts and regional shopping centers;
- Patients, visitors, and employees accessing the many hospitals and medical facilities; and
- Residents and tourists traveling to entertainment and performing arts centers, special event generators, the Anaheim and Los Angeles convention centers, and parks and recreational areas.

1.1.3 Development of Alternatives

The development of transportation alternatives to be considered in the AA study closely follows the explanation of the corridor mobility problem, and definition of study goals and objectives. Identified alternatives are structured to isolate the differences among the potential solutions to the transportation problem, and to highlight the trade-offs inherent in the selection of a preferred alternative. The development and definition of alternatives is typically an iterative process. The first step is the conceptual definition of a broad range of strategies for improving conditions in the corridor. Subsequent evaluation and screening of these conceptual alternatives will narrow the range of viable alternatives to a manageable number to carry forward into a detailed analysis. Conceptual transportation alternatives for the PEROW/WSAB Corridor will be developed based on previous studies and in consultation with elected officials, stakeholders, city and agency staff, and the public. The identified alternatives will be assessed through a three-step screening technical and environmental analysis process based on goals and criteria identified with the community.

1.2 Study Goals and Evaluation Criteria

PEROW/WSAB Corridor-specific goals and criteria were identified based on: local goals identified in consultation with elected officials, stakeholders, and the public; findings of the Corridor Mobility Problem and Purpose and Need analysis prepared as part of the AA study process; and applicable criteria of possible implementing and funding agencies. As documented in the *PEROW/WSAB Corridor AA Evaluation Methodology Report*, a detailed set of corridor goals, criteria, and related performance measures were established to guide identification and evaluation of the proposed transit options. The performance information resulting from the evaluation process will provide decision-makers and the public with information on the benefits and impacts of the alternatives, as well as the differences between the options.

During Project Initiation efforts, stakeholder and community input on project goals and criteria were identified through interviews with elected officials and stakeholders, discussions with the two project advisory committees formed to guide the study process and recommendations, and break-out discussions at community meetings held throughout the Corridor Study Area. The resulting major goals are presented below in the five main categories that correspond to FTA project evaluation categories:

1. Public and Stakeholder Support

- Provide a desirable solution to the community and stakeholders.

2. Mobility Improvements

- Provide another travel option.
- Connect to the regional transit system.
- Serve both community and regional trips.
- Increase access to and from corridor destinations and activity centers.
- Provide a fast travel speed.
- Provide related pedestrian and bicycle facilities.

3. Cost-Effectiveness

- Provide a cost-effective solution.

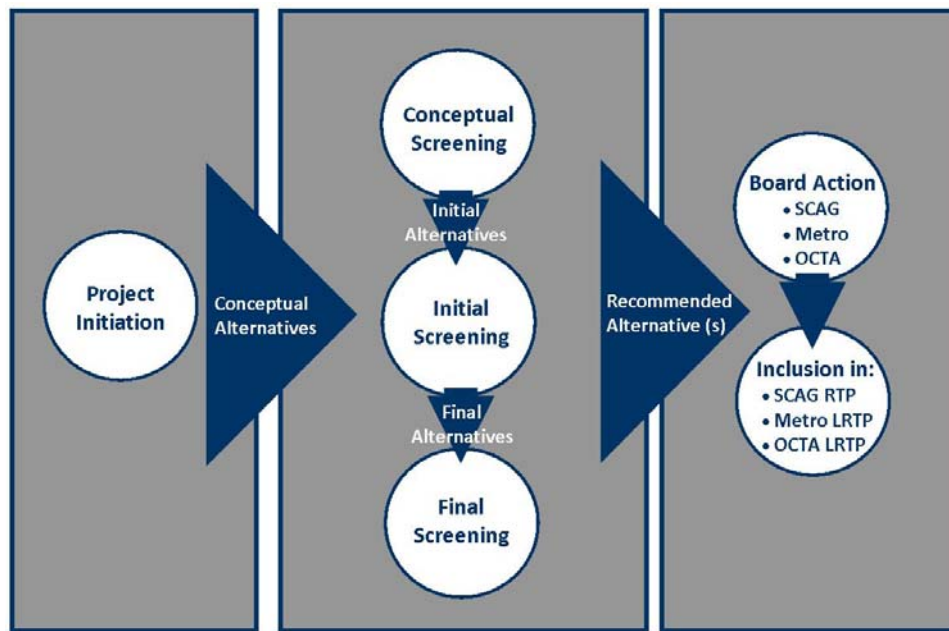
4. Land Use/Economic Plans

- Provide station location and spacing that supports local economic development and revitalization plans and goals.

5. Environmental and Community Impacts

- Identify a project that results in no or minimal environmental impacts to adjacent communities.

Figure 1.1 – Three Step Screening Process



As illustrated in Figure 1.1, the proposed alternatives will be assessed through a three-step screening process incorporating technical and environmental analyses, along with community and stakeholder input. Each evaluation phase will refine the results of the previous effort using more detailed engineering, operational, and environmental analysis, along with continued public input. The evaluation process will include the following three phases:

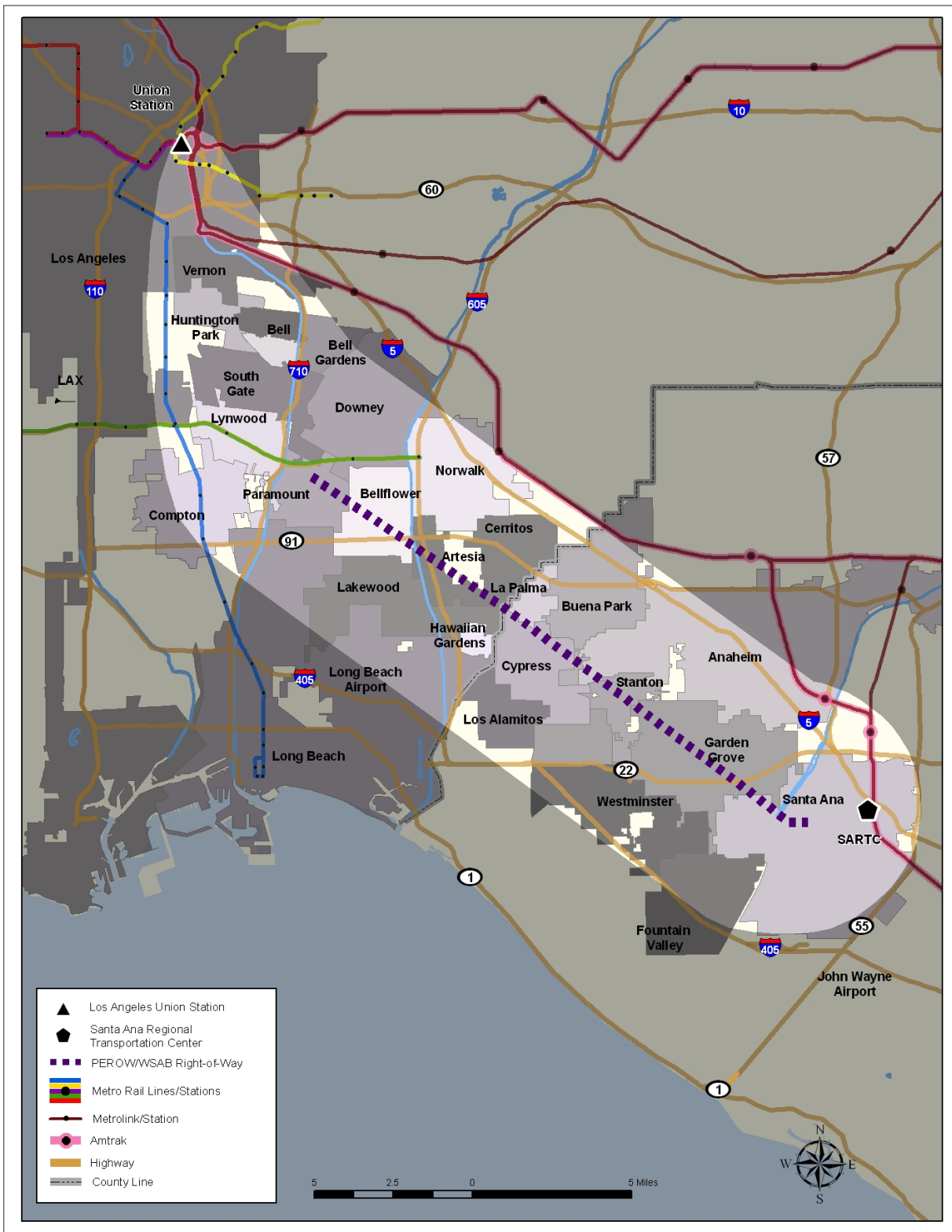
1. **Conceptual Alternatives Screening** – Transportation alternatives identified from previous studies and during Project Initiation outreach, called the Conceptual Set of Alternatives, will be evaluated based on a “meets-does not meet” level of policy and technical assessment. This effort will evaluate each option’s ability to serve locally-defined goals and the identified project Purpose and Need. Technical information, along with additional stakeholder and public input, will guide the definition of an Initial Set of Alternatives to be studied further.
2. **Initial Screening** – The Initial Set of Alternatives, along with the No Build and Transportation System Management (TSM) options, will be assessed based on an initial evaluation of technical and environmental benefits and impacts. This effort will identify the alternatives that best meet the project goals and identified Purpose and Need, are technically viable, and have stakeholder and community support. The technical analysis, along with community input, will result in the identification of the most viable alternatives, called the Final Set of Alternatives, representing varied transit modes for further study.

3. **Final Screening** – The Final Set of Alternatives will be studied and evaluated based on conceptual-level technical information, including engineering and operating design, station location and prototypical design, capital and operating cost estimates, ridership forecast modeling information, land use and economic development support assessment, environmental impact analysis, and other AA study-related evaluation efforts. The resulting technical information, along with stakeholder and public input, will provide the basis for the identification of a recommended transportation alternative for the PEROW/WSAB Corridor. The final recommendation may consist of a single transportation alternative or project, or the priority phasing of several transportation alternatives and related improvement projects, such as integrated bicycle and pedestrian facilities.

1.3 Report Purpose

The purpose of this report is to document the development and evaluation of the Conceptual Set of Alternatives, and the resulting Initial Set of Alternatives, which will lead to the identification of the Final Set of Alternatives. The Conceptual Set of Alternatives is presented in Section 2.0, and the definition and comparative analysis of the Initial Set of Alternatives is presented in Sections 3.0 and 4.0.

Figure 1.1 – Corridor Study Area



2.0 CONCEPTUAL SET OF ALTERNATIVES

During the Project Initiation phase, a Conceptual Set of Alternatives representing a full range of possible transportation types was identified based on previous studies and in consultation with the Corridor Study Area stakeholders and community. The alternatives have been evaluated based on each option's ability to meet the identified project goals and criteria. This meets-does not meet assessment effort has resulted in the identification of an Initial Set of Alternatives to be studied further.

2.1 Identification of Alternatives

During Project Initiation efforts, a set of possible transportation solutions were identified to address the corridor's transportation challenges based on previous studies, in response to the identified Mobility Problem, and in consultation with elected officials, stakeholders, city and agency staffs, and the public. The conceptual alternatives were selected from the following modal categories:

1. **Bus Alternatives** – This rubber-tired, primarily at-grade transit service can be operated in a number of operating scenarios ranging from local bus service to higher travel speed options.
 - **Local, limited stop, and express bus services** – Currently, Corridor Study Area bus transit service is provided on many of the study area's major streets by five operators, and city-based circulator service is offered by six cities. Existing bus service in the Los Angeles County portion of the Corridor includes Metro Rapid service which provides faster street-running service through system integration of a number of key attributes such as bus signal priority, low-floor buses, and fewer stops. Metro Express service, connecting Downtown Los Angeles and central Anaheim in Orange County, operates in the High Occupancy Vehicle (HOV) lanes on the I-105 Freeway and the I-110 Transitway. OCTA provides express peak period bus service to and from Downtown Los Angeles which utilizes a variety of freeways including the I-105 Freeway and the I-110 Transitway. While Transitway bus service reaches 45 miles per hour (mph), street-running bus operations, including Metro Rapid service, operates at 10-14 mph during peak periods. An alternative from this category was not selected as the Corridor Study Area already is well-served by this group of bus services, and faster alternatives were sought by corridor stakeholders.
 - **Bus Rapid Transit (BRT)** – This term refers to various methods of providing faster bus travel. Locally, BRT service is operated in dedicated lanes as the Metro Orange Line in the San Fernando Valley. Within the Corridor Study Area, BRT service has been considered in previous studies, and was recommended for further consideration along the PEROW/WSAB Corridor. This modal alternative had been studied and was screened out of the Santa Ana-Garden Grove Fixed Guideway Project for operation from the Santa Ana Regional Transportation Center along the streets of Downtown Santa Ana west to Harbor Boulevard in the City of Garden Grove. This modal alternative was included in the Conceptual Set of Alternatives.
2. **Urban Rail Alternatives** – Urban rail is an all-encompassing term used for a family of steel wheel on guideway service types providing community- and intra-regional based service. Typically operated at-grade, this group of modal alternatives runs on varied power sources, including diesel motor self-propulsion, overhead electrical catenary, and third rail electrical systems. Urban rail services generally are divided into five categories, some of which overlap:
 - **Street Car** – On the west coast, the best known example of this service type, also referred to as trolleys or trams, is the Portland Street Car system. This community-serving transit alternative

operates primarily at-grade in street lanes shared with vehicular traffic, though some segments run in a separate right-of-way. Within the Corridor Study Area, this modal alternative is under consideration as part of the Santa Ana-Garden Grove Fixed Guideway Project. This modal alternative was included in the Conceptual Set of Alternatives.

- **Light Rail Transit (LRT)** – A term coined by FTA in the 1970s, light rail transit (LRT) is used to identify an evolving rail type that was an outgrowth of street car service. Typically operated separate from street traffic in its own right-of-way, LRT service results in faster service than streetcar and serves both community and intra-regional trips. Metro runs multiple LRT lines throughout Los Angeles County, including the Metro Green Line which serves the northern portion of the Corridor Study Area and the Metro Blue Line which marks the area’s western boundary. This modal alternative was evaluated in previous PEROW/WSAB Corridor studies, and was included in the Conceptual Set of Alternatives.
- **Multiple Unit Systems** – Sometimes classified as LRT, these self-propelled transit systems are often used to provide commuter service on short and medium length trips, and do not typically operate at the same frequency as a LRT system. For example, the North County Transit District (NCTD) operates multiple unit service at 30-minute headways all day, while Metro LRT service operates at peak period headways of five to seven minutes. Multiple unit systems can be either diesel- or electrically-powered. Diesel multiple unit (DMU) systems consist of multiple passenger cars powered by one or more on-board diesel engines. Multiple unit service also can be electrically-powered (EMU) and requires an electrical catenary-substation system similar to LRT service, or a “pick-up shoe” for a third rail system. In California, non-Federal Railroad Administration (FRA) compliant DMU service is operated by the NCTD in northern San Diego County. DMU service was identified as a possible corridor option based on the lower construction cost than a LRT system. As the operation and cost of an EMU system is similar to that of LRT service, only a DMU alternative was included in the Conceptual Set of Alternatives.
- **Rapid Transit** – More commonly known as heavy rail or subway, this transit type provides high capacity, frequent service that is grade-separated from other rail and vehicular traffic. Currently, this service type is provided in Los Angeles County by the Metro Red and Purple subway lines. This transportation option was not identified for consideration in the PEROW/WSAB Corridor based on two key factors:
 - Forecast corridor ridership from previous studies, and current transit ridership and travel patterns identified by the corridor-based travel demand model, did not support consideration of a heavy rail system that typically serves 100,000 and more daily boardings; and
 - While the corridor has some areas of high residential and employment density, the study area’s typical land use patterns and density are more suburban in character and would not generate a consistently high level of ridership necessary to support the need for a heavy rail system.

Figure 2.1 – Transit Alternatives



- **Monorail** – This travel mode consists of a single rail system mounted on an overhead beam with vehicles straddling the beam. This option did not appear to meet the Corridor Purpose and Need, and was not identified in any previous corridor study or by stakeholders and the public in this AA effort, and was not included in the Conceptual Set of Alternatives.
3. **High Speed Alternatives** – High speed service is defined as passenger rail transport that operates at significantly higher speed than traditional rail service. In Europe and Asia, high speed systems operate at maximum speeds ranging from 220 to 330 mph; and in the U.S., Amtrak’s Acela Express has a maximum speed of 150 mph. High speed systems serve longer distance trips between major cities and regional destinations, and are typically operated on exclusive right-of-ways, and in many cases are grade-separated to maximize operational speeds and minimize safety impacts on other modes. High speed vehicles are self-powered by clean diesel engines, or are electrically-powered by overhead catenary lines, or below the surface induction motors. The following modal options are sub-categories under the High Speed Alternative, and were included in the Conceptual Set of Alternatives:
- **Commuter Rail Service** – Commuter rail or regional rail runs on trackage often shared with intercity rail (Amtrak) and/or freight trains, and typically serves lower density suburban communities. Locally, Metrolink operates commuter rail service along 512 miles in a five county service area that includes Los Angeles and Orange counties, along with Riverside, San Bernardino, and Ventura counties.
 - **Conventional Steel Wheel High Speed Rail Service** – Conventional steel wheel on steel rail high speed rail (HSR) service provides passenger rail transport at significantly higher speeds than traditional passenger rail service such as that currently provided in Southern California by Metrolink and Amtrak. On the East Coast, Amtrak introduced its first higher speed service in 1969 with “Metroliner” service operating at 125 mph, followed with Acela service running at 150 mph. At the state level, HSR planning efforts have been initiated through the creation of the California High-Speed Rail Authority to develop a high speed train system connecting northern and southern California.
 - **Magnetic Levitation High Speed Service** – Maglev is a system of transportation that suspends, guides, and propels vehicles, predominantly trains, using magnetic levitation from a large number of magnets for lift and propulsion. While not currently operating in the U.S., Japan, China, and South Korea have maglev systems in operation serving the public. The Shanghai Maglev train operates at an average speed of 160 mph and a maximum of 268 mph and transports passengers over 19 miles to the Shanghai Airport.
4. **Highway Alternatives** – No highway alternatives were identified or proposed at the briefings, meetings, and community work sessions with corridor elected officials, stakeholders, and the public. Highway system options were identified as not meeting the identified Purpose and Need for this project, which were to: expand travel options; add travel capacity without impacting the environment; improve connections to the regional transit system; and serve the forecasted growth in transit service needs of low-income and senior residents. A majority of the participants viewed the purpose of this study, and the reuse of the PEROW/WSAB ROW, as providing a high-capacity, transit system improvement.

2.2 Conceptual Set of Alternatives

Following the initial identification of transit strategies, a Conceptual Set of Alternatives was identified primarily in consultation with elected officials, stakeholders, city and agency staff through briefings and advisory committee meetings, and the public at a series of six community meetings. The following set of corridor-specific transit options was identified:

- **No Build Alternative**, or complete the transportation improvements which already have committed local, regional, state, and federal funding. This option is required for comparison purposes, and was identified by Corridor stakeholders and the public as a viable option.
- **Transportation Systems Management (TSM) Alternative**, or maximize the use of the existing transportation system through minor operational and physical improvements. This option is required for comparison purposes, and was identified by corridor stakeholders and the public as a viable alternative.
- **Build Alternatives**, or locally-identified options which provide a new transportation solution. The following seven build transportation options were identified for consideration:

1. Bus Alternative

- **Bus Rapid Transit (BRT)** – Provide high speed bus service operating in dedicated lanes along the former PEROW/WSAB ROW, and connecting north to Downtown Los Angeles via either freeway HOV lanes, or street-running operations; and connecting south from the ROW via street-running operations through Downtown Santa Ana to the SARTC.

2. Urban Rail Alternatives

- **Street Car** – Build a community-oriented rail system similar to that being considered by the cities of Santa Ana and Garden Grove.
- **Light Rail Transit (LRT)** – Build a LRT rail system similar to the Metro Gold and Blue Lines in Los Angeles County.
- **Diesel Multiple Unit (DMU)** – Build a self-powered DMU rail system similar to the Sprinter service operated by the NCTD in northern San Diego County.

3. High Speed Service Alternatives – Build a high speed system including the following options:

- **Commuter Rail Service** – Provide a system similar to Metrolink service operated throughout Southern California.
- **Conventional Steel Wheel High Speed Rail** – Implement high speed rail service similar to service that is being planned by the California High Speed Rail Authority, and is operated by Amtrak in the eastern U.S., and by others throughout Europe and Asia.
- **Magnetic Levitation High Speed Service** – Provide high speed magnetic levitation (maglev) service similar to systems operating in Asia.

2.3 Conceptual Screening Process and Criteria

At this preliminary level of screening, the operational definition of the Conceptual Set of Alternatives was based on existing systems similar to those proposed for the PEROW/WSAB Corridor Study Area as identified above. Table 2.1 provides a summary of the speed and station spacing information for each of

the Build Alternatives included in the Conceptual Set of Alternatives based on similar systems primarily operating in Southern California.

Table 2.1 – Conceptual Alternatives – Operational Information

Information	Bus Rapid Transit	Street Car	Light Rail Transit	Diesel Multiple Unit	Commuter Rail	High Speed Service
Average speed (miles per hour)	22	8.5-15	22-35	22	42	90-95
Maximum speed (miles per hour)	35	40	55-65	55	70-90	110-270
Station spacing (miles)	1.0	0.2-0.5	1.0-1.5	1.5-3.0	6.0-7.0	10.0-20.0

During this first phase of analysis in the AA process, the identified Conceptual Set of Alternatives was evaluated based on each option's ability to meet locally-defined regional transportation system connectivity, operational and economic development goals. Conceptual-level technical analysis was based on similar existing systems, and the alternatives were evaluated on a meet-does not meet basis. The following criteria were used to evaluate the Conceptual Set of Alternatives:

1. **Community and stakeholder interest and/or support** – Is there demonstrated public interest and/or support for the proposed transportation alternative?
2. **Serves both community and regional trip types** – Does the alternative have the ability to provide both convenient access to local destinations and the ability to quickly reach regional destinations?
3. **Provides fast service** – Does the alternative have a demonstrated operational speed that would be faster than current transit and current and forecast auto travel?
4. **Station spacing supports local economic revitalization and development goals** – Does the typical station spacing of the proposed alternative support local economic development and revitalization goals and plans?
5. **Provides capacity flexibility to serve peak and non-peak trips** – Does the proposed alternative have the capacity and flexibility to serve both peak and non-peak trips? Can non-peak period service be operated in a cost-effective manner? For example, LRT service can be scaled from a single car to a three car train to match operational needs.
6. **Compatible with current transit operations** – Are the proposed alternatives compatible with existing and future transit systems and operational plans? What transit service operator would construct, operate, and maintain each of the proposed alternatives? Would a new service entity be required?
7. **Compatible with freight rail operations** – As the alignments of the alternatives leave the PEROW/WSAB Corridor ROW to connect north to Downtown Los Angeles, the proposed options will travel along rail ROWs that may be shared with freight and/or Metrolink passenger rail operations. Is the proposed alternative compatible with freight rail operations, or is there

sufficient right-of-way to accommodate the proposed transportation alternative adjacent to or above the tracks being utilized by freight traffic? Is the alternative's proposed vehicle identified as crash-compliant by the Federal Railroad Administration (FRA)?

2.4 Conceptual Screening Results

The results of the conceptual screening effort are presented below in Table 2.2. The resulting findings were identified based on the following parameters:

- **Public Support** – was solicited through a series of elected official and stakeholder briefings, Project Technical Advisory and Steering Committee meetings, and six community meetings.
- **Trip Types** – was assessed based on whether the alternative could serve local and/or regional trips based on station spacing, resulting operational speeds, and Southern California experience.
- **Speed** – As identified by corridor stakeholders and the public, the two criterion used to determine whether an alternative improves travel speed were: average Metro Blue Line travel speed (25 mph) as the one transit line that most people were familiar with; and average peak period travel speed for the I-5 Freeway (35 mph or less).
- **Station Spacing** – Many Corridor Study Area cities have economic development and revitalization plans, and alternatives with a more frequent station spacing serving more cities were identified as providing a higher level of support for local development goals than those with wider spacing based on operational parameters.
- **Service Capacity and Flexibility** – Anticipated ridership levels were identified based on previous Corridor Study Area studies and compared to the passenger capacity provided by typical vehicles for each of the proposed alternatives; and cost-effective service flexibility was identified based on ability of each of the typical vehicles to be reconfigured to serve peak and non-peak services. For example, LRT service can be scaled from a single car to a three car train to match operational needs.
- **Compatible with Current Transit Operations** – Assessed on whether there was an existing transit service operator that could construct, operate, and maintain the proposed alternative, or whether a new service entity would be required.
- **Fit with Freight Rail Operations** – Assessed ability to share existing freight rail ROWs north from terminus of PEROW/WSAB ROW north to Downtown Los Angeles based on FRA rulings and requirements related to shared-operations and crash-compliant vehicles.

Table 2.2 – Overview of Conceptual Screening Findings

Criteria	Alternative					
	BRT	Street Car	LRT	DMU	Commuter Rail	High Speed Service
Public Support	Minor community and stakeholder support/interest	Some community and stakeholder support/interest	Strong community and stakeholder support/interest	Some community and stakeholder support/interest	Lack of community and stakeholder support/interest	Some community and stakeholder support/interest
Trip Types	Serves local trip purposes, not regional trips (depends on station spacing/ service plans)	Serves local community-based trips, not regional trips (depends on station spacing/ speed capability of vehicle)	Serves both local and regional trip purposes	Serves both local and regional trip purposes	Serves regional trip purpose	Serves regional trip purpose
Speed	Average speed slower than Metro Blue Line/ I-5 peak period speed	Average speed slower than Metro Blue Line/ I-5 peak period speed	Dedicated ROW speed is faster than Metro Blue Line/ I-5 peak period speed	Requires dedicated ROW; speed is faster than Metro Blue Line/I-5 peak period speeds	Requires dedicated ROW; speed is faster than Metro Blue Line/I-5 peak period speeds	Requires dedicated ROW; speed is faster than Metro Blue Line/I-5 peak period speeds
Station Spacing	Station spacing would provide medium level of support for local economic development/ revitalization goals and plan	Station spacing would provide high level of support for local economic development/ revitalization goals and plan	Station spacing would provide high level of support for local economic development/ revitalization goals and plan	Station spacing would provide medium level of support for local economic development/ revitalization goals and plans	Station spacing (6.5 miles) would provide low level of support for local economic development/ revitalization goals and plans	Station spacing (10-20 miles) would provide low level of support for local economic development/ revitalization goals and plans
Capacity/ Flexibility	May not accommodate forecast peak ridership; has flexibility to serve peak/non-peak needs	May not accommodate forecast peak ridership; has flexibility to serve peak/non-peak needs	Accommodates forecast peak ridership; has flexibility to serve peak/non-peak needs	Accommodates forecast peak ridership; has flexibility to serve peak/non-peak needs	Accommodates forecast peak ridership; does not have flexibility to serve non- peak needs	Accommodates forecast peak ridership; does not have flexibility to serve non- peak needs
Compatibility with Current Systems/Plans	Currently operated by Metro; planned operations by OCTA	Under study by cities of Santa Ana and Garden Grove	Currently operated by Metro	No existing operator in study area	Currently operated by Metrolink	No existing operator in study area; future CHST system will operate along northern edge of study area

Table 2.2 – Overview of Conceptual Screening Findings

Criteria	Mode					
	BRT	Street Car	LRT	DMU	Commuter Rail	High Speed Service
Compatibility with Freight Rail Service Operations	Not freight rail compatible; FRA decision on proposed BRT operations on Harbor Sub as part of the Crenshaw Corridor AA	Not freight rail compatible; requires temporal/time separation or separate tracks	Not freight rail compatible; requires temporal/time separation or separate tracks	Not freight rail compatible; requires temporal/time separation or separate tracks	Freight rail compatible	Not freight rail compatible; requires separate tracks (Conventional HSR can share)

The conceptual screening results were presented to and discussed at: 1) briefings held with elected officials and stakeholders from each Corridor Study Area city; 2) advisory committee meetings held with the Technical Advisory Committee and Steering Committee; and 3) six community workshops conducted throughout the Corridor Study Area. There was consensus to remove the Commuter Rail Alternative, while continuing to study the remaining six build alternatives.

The Commuter Rail Alternative was recommended for deletion from further study based on a number of factors, several of which reflected the community's experience with freight rail service operating in the PEROW/WSAB Corridor ROW and other locations. While this alternative had benefits, including ease of implementation, connectivity with existing Metrolink service operated throughout Southern California, and vehicles that are freight rail compatible, this option was viewed as having significant impacts that outweighed the benefits. The following concerns were identified by stakeholders and the public:

- Commuter rail vehicles are similar in size and weight to freight train locomotives and would result in major noise, vibration, visual, and privacy impacts to homes and businesses along the corridor. In addition, the 16-foot high, bi-level vehicles currently used by Metrolink were viewed as the not compatible in scale with the primarily one- to two-story development along the corridor.
- The Commuter Rail Alternative was seen as a duplication of existing Metrolink service operating adjacent to the north of the Corridor Study Area, and already serving the corridor's two major destinations – Downtown Los Angeles and Santa Ana.
- This alternative was perceived as primarily serving regional commuter trips, which did not reflect the corridor's perceived travel needs. As presented above in Section 1.0, future Corridor Study Area trips will not just be focused on the work trip market, but also will include a wide range of non-work-related trips, including residents and visitors traveling to school, shopping, recreational, cultural, and entertainment destinations.
- While the Commuter Rail Alternative's station spacing did facilitate a faster travel speed, the average of 6.5-miles between stations did not support the corridor's local economic revitalization and development goals and plans. Based on Metrolink station spacing, this modal alternative typically would provide only six to seven stations in the Corridor Study Area, leaving 15 cities unserved.

- Commuter Rail service was not viewed as having the flexibility to serve non-peak needs in a cost-effective manner, as each train would require a costly locomotive whether handling one or six passenger cars.

Table 2.3 provides a summary of the screening results for the Conceptual Set of Alternatives. Three evaluation areas require further analysis to make a final determination:

- ***Provides fast travel service*** – For the BRT and Street Car alternatives, the resulting travel speed will depend on the final station spacing, as well as operational and vehicle selection decisions. Both options typically have closer station spacing than that provided by LRT and DMU service, resulting in a slower travel speed. For the proposed BRT alternatives, there is a significant difference in travel times related to street-running and freeway HOV-operating service. In addition, detailed operational plans need to be identified, and the ability to operate express or “skip stop” service may provide faster travel times between key destinations. For the Street Car Option, the final travel time will depend on the vehicle selected. Designed to operate in mixed-flow street operations, the Portland-type vehicle has a maximum speed of 40 mph, while European street cars can operate at speeds of up to 55 mph.
- ***Compatible with current transit systems and/or plans*** – In this category, three options were identified as requiring further clarification: 1) street car service may be operated in the future by OCTA as a result of the Santa Ana-Garden Grove Fixed Guideway Study; no Corridor Study Area operator currently provides DMU service, though Metro has studied DMU service along several other alignments; and Conventional Steel Wheel HSR service requires further analysis and discussion regarding its potential integration with the planned California HSR system.
- ***Compatible with freight rail operations*** – Sufficient information is not available at this level of analysis to determine if there is adequate freight track ROW width to accommodate the addition of the proposed transit alternatives, or whether temporal (time) separation is feasible. In addition, a more detailed identification and evaluation of FRA-approved, crash-compliant vehicles for each of the alternatives will need to be completed.

Table 2.3 – Summary of Conceptual Screening Results

Criterion	Conceptual Alternatives					
	BRT	STCR	LRT	DMU	CR	HSS
Community/stakeholder support and/or interest	•	✓	✓	✓	•	✓
Serves community and regional trips	✓	•	✓	✓	•	•
Provides fast travel service	□	□	✓	✓	✓	✓
Station spacing supports local economic development/revitalization goals	✓	✓	✓	✓	•	•
Accommodates peak and non-peak service needs	✓	✓	✓	✓	•	•
Compatible with current transit systems/plans	✓	□	✓		✓	□/•
Compatible with freight rail operations	•	□	□	□	✓	□

✓ Yes • No □ Dependent on station spacing, vehicle selected, and operational decisions.

3.0 INITIAL SET OF ALTERNATIVES

This section provides a general description of the Build Alternatives included in the Initial Set of Alternatives as identified based on a comparative technical assessment and input from elected officials, stakeholders, project advisory committees, and the public. Information provided presents a general discussion of each alternative's modal information, proposed alignments and operational configurations, and proposed stations.

Under FTA guidance published in 2000, the requirement for separate No Build and TSM alternatives was eliminated, and instead identified that the proposed "build" alternatives be evaluated against a single "Baseline Alternative." An initial decision has been made in this AA to evaluate a No Build and a TSM alternative due to the strong interest from the corridor community in both alternatives. At this point in the process, the details of these two baseline alternatives are not presented. The projects included in the No Build Option are defined by the adopted financially constrained long range regional transportation plans (LRTPs) of Metro, OCTA, and SCAG. The transit service and highway system improvements to be included in the TSM Alternative will be identified during the Final Screening evaluation phase based on input from Metro and OCTA.

3.1 No Build Alternative

The No Build Alternative is used for comparison purposes to assess the relative benefits and impacts of constructing a new transit project in the Corridor Study Area versus implementing only currently planned and funded projects. This option includes all of the projects that are identified for construction and implementation in the "Constrained Plan" of Metro's adopted *2009 Long Range Transportation Plan (LRTP)*, and in the "Preferred Plan" of OCTA's 2010 LRTP, *Destination 2035*. The Metro LRTP does include a project for the West Santa Ana Branch Corridor, while the OCTA LRTP does not include a project for the Orange County portion of the project. The Santa Ana-Garden Grove Fixed Guideway Project, which will utilize a portion of the PEROW/WSAB Corridor, is funded through the "Transit Projects" portion of the Orange County's LRTP.

In addition to providing a comparative basis for the build options in the AA evaluation process, the No Build Alternative was identified as a preferred alternative by some cities, stakeholders, and members of the public.

3.2 Transportation System Management (TSM) Alternative

The Transportation System Management (TSM) option is required for comparison purposes to effectively measure the resulting mobility improvements from implementing a major transportation improvement. It is intended to address the same mobility needs as the build alternatives, by maximizing the use of the existing transportation system through minor improvements. The TSM Alternative will not include the construction of a major transportation project, such as a transit guideway, resulting from this study effort. Thus, typically the TSM Alternative will have a lower level of capital investment. This option will include all of the provisions of the No Build Alternative, plus identified improvements to the existing transportation system such as increasing bus service, providing new pedestrian and bicycle facilities, improving traffic flow with minor street widening and signalization improvements. Definition of the projects to be included in the TSM Alternative will be identified with Metro and OCTA staff during the Final Screening phase.

In addition to providing a comparative basis for the build options in the AA evaluation process, the TSM Alternative was identified as a preferred alternative by some cities, stakeholders, and members of the public during Project Initiation and Conceptual Screening efforts. There was strong interest in the creation of a linear pedestrian and bicycle trail system along the PEROW/WSAB Corridor.

Build Alternatives

The following discussion presents a description of the six build options in the Initial Set of Alternatives, including:

1. **General Description** – A brief overview of each alternative’s modal information.
2. **Proposed Alignment and Operational Configuration** – A conceptual description of the horizontal and vertical alignments considered for each alternative.

The **horizontal alignment**, or how the options will travel through the corridor cities, is shown as a single line at this point in the analysis. Along the PEROW/WSAB Corridor, all of the alternatives were evaluated as operating in the center of the right-of-way. For the connection into Downtown Los Angeles north from the terminus of the PEROW/WSAB Corridor ROW in the City of Paramount, a range of possible alignments was identified for the bus, urban rail, and high speed service alternatives and are discussed below.

At this level of analysis, the **vertical alignment**, or whether the alternative operates at-, above-, or below-grade, was evaluated based on the entire alignment of each alternative running at-grade or grade-separated as presented below in Table 3.1. It should be noted that there were two exceptions to the analysis: high speed service requires grade-separation for operational and safety reasons; and BRT and DMU service typically is not operated in a below-grade or subway configuration due to safety concerns related to diesel fuel ventilation issues. This decision to analyze the options as operating in a single vertical configuration reflects the conceptual level of alternative definition of the options, and allowed for a consistent level of the evaluation information among the alternatives at this conceptual level of analysis. As the alternatives move into the Final Screening phase, a preliminary definition of the appropriate combination of vertical system operations will be identified based on: technical analysis, Metro’s adopted Grade Separation Policy as applicable, and coordination with the affected cities.

Table 3.1 – Initial Screening Vertical Alignments

Alignment	Bus Rapid Transit	Street Car	Light Rail Transit	Diesel Multiple Unit	High Speed Service
At-Grade	✓	✓	✓	✓	-
Above-Grade	✓	✓	✓	✓	✓
Below-Grade	-	✓	✓	-	✓

3. **Proposed Stations** – An overview of the preliminary set of stations identified in initial work sessions with the cities.

During September 2010, **conceptual station locations** were identified in working sessions held with the corridor cities, with the expressed understanding that the final number and location of the

stations will be refined with the individual cities at the initiation of Final Screening efforts. At this initial level of design and analysis, station spacing was based on a station per city, or an average of two-miles apart for the BRT and Urban Rail alternatives, and approximately six miles apart for the two high speed service alternatives. The BRT and Urban Rail alternatives have the same station locations along the PEROW/WSAB ROW, but vary along the northern and southern connections.

In the more detailed design work undertaken during the Final Screening phase, station spacing may be more frequent depending on the build alternative, system needs, and city desires. Work sessions will be held with individual cities to confirm station locations, identify additional stations depending on the alternative/alignment, possible station facilities, open space and/or joint development opportunities, and other station-related issues specific to each city. It should be noted that the resulting project capital cost estimate will only cover project-related facilities necessary for transit operations such as the system, vehicles, operational systems, and station. Any proposed station area open space and/or joint development improvements would be funded through other public and private sources.

The alignments and stations for the alternatives would be refined with the affected cities if the alternative is carried forward for additional study.

3.3 Bus Rapid Transit Alternative

The Bus Rapid Transit (BRT) Alternative is defined as high capacity, higher speed bus service operating in dedicated lanes similar to the Metro Orange Line now operated by Metro in the San Fernando Valley. Metro Orange Line vehicles are 60 feet in length and are self-powered by alternative fuel engines. The Metro vehicles accommodate 57 seated passengers, and have a total capacity of 74 passengers. Operating in dedicated lanes on a former railroad ROW, the average speeds are 22 mph, with top speeds of 35 mph. Metro operates peak period service of 4-5 minutes, with a 10 minute mid-day frequency. The Metro Orange Line currently carries 21,100 daily riders.

3.3.1 Bus Rapid Transit Alternative Operational Description

Conceptual BRT service alignments were identified and will be refined in further consultation with corridor stakeholders and cities during Final Screening. Two BRT operational scenarios were defined, and while they both have the PEROW/WSAB Corridor and the connection south through the City of Santa Ana in common, the proposed connection north from the PEROW/WSAB ROW terminus in the City of Paramount to Downtown Los Angeles differs:

- **HOV-operating Option** – This alternative would operate in HOV lanes along the I-105 and I-110 freeways into the western portion of Downtown Los Angeles and continue in street-running operations;
- **Street-running Option** – This alternative would leave the PEROW/WSAB ROW to run north on Lakewood Boulevard to interface with the Metro Green Line Lakewood Boulevard Station and then continue north in street-running operations with signal priority to Union Station in the eastern portion of downtown.

As shown in Figures 3.1 and 3.2, the proposed BRT alternatives operate in three service alignments:

- **Dedicated lanes** along the PEROW/WSAB Corridor ROW between the City of Paramount in Los Angeles County and the City of Santa Ana in Orange County;
- **Street-running operations** with signal priority connecting north from the PEROW/WSAB Corridor ROW terminus to Union Station in Downtown Los Angeles, and street-running operations with signal priority connecting south from the corridor ROW terminus in the western portion of the City of Santa Ana through Downtown Santa Ana to the SARTC; and
- **Freeway HOV lane operations** connecting north from the PEROW/WSAB Corridor ROW terminus with BRT service operating on the HOV lanes located in the I-105 and I-110 Freeways.

The preliminary set of BRT stations presented in Table 3.2 is based on: 1) working sessions with the cities along the PEROW/WSAB Corridor; and 2) for the northern connection alignments, the initial set of stations includes existing Metro Rapid and I-110 Transitway stations. If this alternative moves forward into the next study phase, the number and location of the BRT stations will be refined based on technical analysis and input from the affected cities.

Table 3.2: BRT Alternatives – Preliminary Set of Stations

Common to Both Alternative Alignments	
Station Location	City
Lakewood Boulevard	Downey
Bellflower Boulevard	Bellflower
183 rd Street/Gridley Road	Cerritos
Pioneer Boulevard	Artesia
Cypress College	Cypress
Beach Boulevard	Stanton
Brookhurst Street	Garden Grove
Harbor Boulevard	Garden Grove
Bristol Street	Santa Ana
Santa Ana Regional Transportation Center	Santa Ana
I-110 Transitway Stations	
37 th Street/USC (existing)	Los Angeles
Slauson Avenue (existing)	Los Angeles
Manchester Boulevard (existing)	Los Angeles
Harbor Freeway (existing)	Los Angeles
Northern Connection Street-Running Stations	
TBD in next study phase (currently Metro Rapid stations are shown)	Downey, Lynwood, South Gate, Huntington Park, Maywood, Vernon, Los Angeles
Southern Connection Street-Running Stations	
TBD in next study phase	Santa Ana

Figure 3.1 – BRT Alternatives: Northern Alignment Alternatives

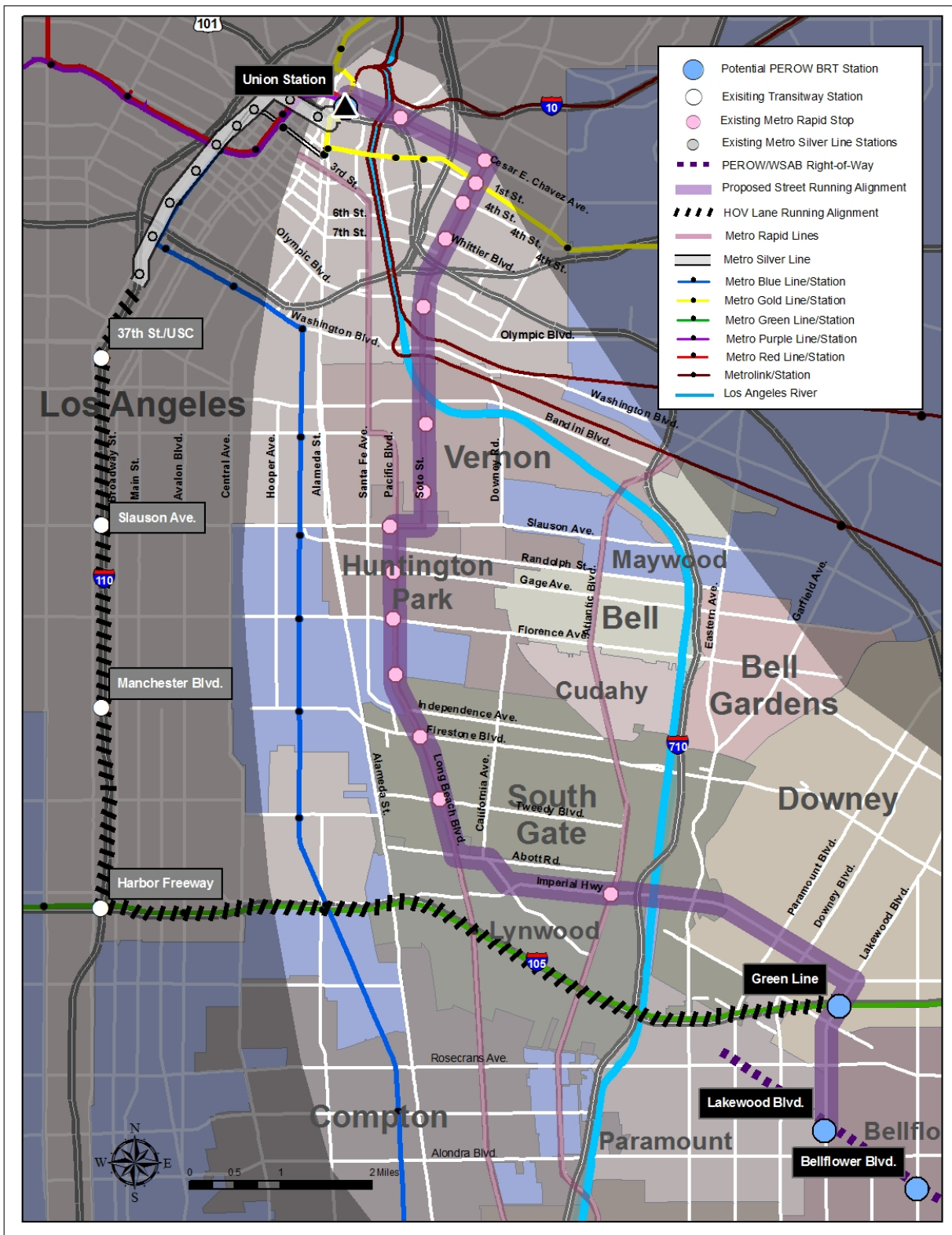
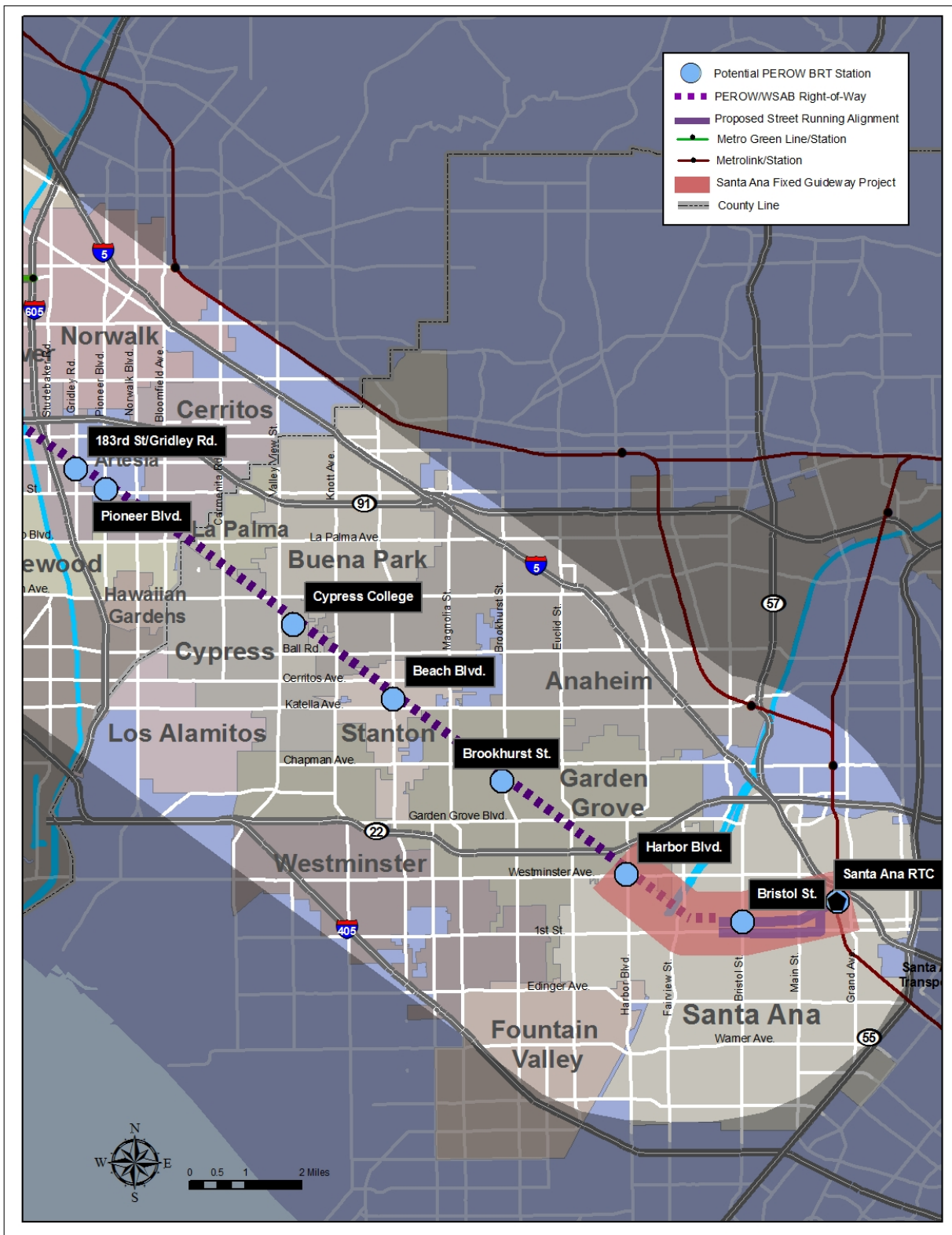


Figure 3.2 – BRT Alternatives: Southern Alignment Alternatives



3.4 Urban Rail Alternatives

Urban rail is a term used for a family of steel wheel on guideway service types providing community- and intra-regional based service. Typically operated at-grade, urban rail systems can be designed to run in aerial and below-grade service configurations dependent upon environmental impacts, if any. This group of alternatives provides a wide range of service speeds from a low of 8.5 mph for street car service in mixed flow traffic conditions to 55 mph for a LRT system in an aerial guideway configuration. The daily passenger capacity of the systems can range from 12,500 for Portland's Street Car System to a high of the 80,000 riders served by the Metro Blue Line (which is nearing capacity). The Initial Set of Alternatives includes three urban rail alternatives:

- **Street Car** – Build a community-oriented rail system similar to that in operation in the City of Portland, and being considered by the cities of Santa Ana and Garden Grove;
- **Light Rail Transit (LRT)** – Build a rail system similar to the Metro Gold and Blue Lines in Los Angeles County; and
- **Diesel Multiple Unit (DMU)** – Build a self-powered rail system similar to the Sprinter service in northern San Diego County.

3.4.1 Street Car Alternative

This alternative reflects building a community-oriented rail system similar to that being considered by the cities of Santa Ana and Garden Grove, and in operation throughout the U.S., including the cities of Portland, Seattle, Atlanta, and New Orleans. Street car service has frequent stops spaced from two blocks to one-half-mile apart with minimal station facilities. The Portland cars are 32 feet long and operated singly to negotiate narrow city streets and tight turns. Street car systems are electrically-powered through an overhead electrical catenary system supported by small, frequent traction power substations. Vehicles have a typical operating speed of 8.5 to 15 mph in mixed flow conditions, with a maximum speed of 40 mph in a dedicated right-of-way, though larger European street cars can operate at up to 55 mph in the same conditions.

3.4.2 Light Rail Transit Alternative

The Light Rail Transit (LRT) alternative reflects an urban rail system similar to the Metro Gold and Blue Lines currently in operation within Los Angeles County. Locally, while primarily run at-grade, this alternative also is operated in aerial and/or underground configurations where required. In Los Angeles County, the decision on whether to grade separate LRT service is guided by Metro's *Grade Crossing Policy for Light Rail Transit*, which provides a structured process for the evaluation of potential grade separated versus at-grade operations, in conjunction with environmental analysis. LRT service has less frequent stops than street car service (approximately one mile apart), and has stations that may include bus plazas, parking structures, and joint development. Metro LRT vehicles are 90 feet in length, and are operated in consists of one to three vehicles. LRT systems are electrically-powered through an overhead electrical catenary system supported by traction power substations. LRT systems have a typical operating speed of 25 to 35 mph in at-grade conditions, with maximum speeds of up to 55-65 mph when grade-separated or running in a protected right-of-way.

3.4.3 Multiple Unit Alternative

Self-propelled multiple unit systems can be either diesel- or electrically-powered: diesel multiple unit (DMU) systems are powered by one or more on-board diesel engines, while electric multiple unit (EMU) systems require an electrical catenary-substation system similar to LRT service. As the operation and cost of an EMU system is similar to that of LRT service, only a DMU alternative was included in the Initial Set of Alternatives. It should be noted that even clean diesel operations may have a negative impact on air quality in this non-attainment region, and may not comply with Metro and other local, regional, and federal clean air policies. DMU service is operated by the NCTD in northern San Diego County where it shares a railroad ROW with freight rail traffic. When sharing a freight rail ROW, passenger rail vehicles must be freight rail compatible as identified by the FRA, or must either operate on a separate track, or through temporal (time) separation. NCTD vehicles are non-FRA compliant and operate during on a different schedule than freight rail service. Most DMU systems typically do not operate at the same frequency as a LRT system; NCTD service is provided on a 30 minute schedule. DMU service has an average operating speed of 22 mph, with a top speed of 55 mph; the typical station spacing is 1.5 to 3.0 miles apart.

3.4.4 Urban Rail Operational Description

Conceptual Urban Rail service alignments were identified, and will be refined in further consultation with corridor stakeholders and cities during Final Screening, which will include an analysis of environmental and engineering issues. Two general Urban Rail alignment scenarios were identified, and while both options have the PEROW/WSAB Corridor ROW and the southern connection through the City of Santa Ana in common, there are three options for the connection north from the PEROW/WSAB ROW terminus in the City of Paramount to Downtown Los Angeles:

- **Existing Metro system** – The proposed alignment would travel north on Lakewood Boulevard in the City of Bellflower to connect with the Metro Green Line at the Lakewood Boulevard Station. Passengers would transfer to the Metro Green Line, and then to the Metro Blue Line to reach Downtown Los Angeles.
- **East Alignment Alternative** – Under this option, the alignment would connect from the northern terminus of the PEROW/WSAB Corridor ROW to the San Pedro subdivision ROW now owned by the Ports of Long Beach and Los Angeles. Urban rail travel would share the ROW with the infrequent freight rail traffic north to where the port-owned ROW intersects with a UP-owned ROW utilized by freight and Metrolink passenger rail service. It would share the UP ROW for a short distance to where the ROW, owned by Metro and operated by Metrolink, turns north to travel along the east bank of the Los Angeles River and crosses into Union Station. An assessment of the physical and operational fit within existing railroad ROWs will be prepared during the Final Screening phase of the AA study.
- **West Alignment Alternative** – The proposed alignment would connect from the northern terminus of the PEROW/WSAB Corridor ROW to the railroad ROW owned by the Ports of Long Beach and Los Angeles. Urban rail travel would share the ROW with the infrequent freight rail traffic north to where it would then turn west to travel along one of several existing and former railroad ROWs, such as those located in the median of Independence Avenue or Randolph Street, to the proposed vicinity of Alameda Street. At this point, the alignment would travel north possibly along Alameda Street or another street to connect north to Downtown Los Angeles.

As shown in Figures 3.3 and 3.4, the proposed Urban Rail Alternative operates in three service alignments:

- **Dedicated lanes** along the PEROW/WSAB Corridor ROW between the City of Paramount in Los Angeles County and the City of Santa Ana in Orange County;
- **Railroad ROW-running operations** connecting north from the PEROW/WSAB Corridor ROW terminus utilizing several active and inactive railroad ROWs along either the eastern or western side of the Los Angeles River; and
- **Street-running operations** connecting north from several possible existing and former railroad ROWs into Downtown Los Angeles, and south from the corridor ROW terminus to either interface with the future Santa Ana-Garden Grove Fixed Guideway Project, or to operate along the streets of Downtown Santa Ana to the SARTC.

The preliminary set of Urban Rail stations, identified in working sessions with the cities along the PEROW/WSAB Corridor ROW, is presented in Table 3.3. During Initial Screening efforts, an initial set of stations was identified only for the East Alignment Alternative, as all of the build alternatives have the eastern Los Angeles River bank routing in common adjacent to Downtown Los Angeles, and this allowed for an equitable comparison of the options. If the Urban Rail alternatives move forward, the number and location of the stations will be refined based on technical analysis and input from the affected cities.

Table 3.3: Urban Rail Alternatives – Preliminary Set of Stations

Northern Connection (Railroad ROW) Stations (East Alignment)	
Station Location	City
Union Station	Los Angeles
Soto/Olympic	Los Angeles
Leonis/District	Vernon
Gage/Florence	Huntington Park
Firestone Boulevard	South Gate
Gardendale Street	South Gate
New Metro Green Line Station	Paramount
Paramount/Rosecrans	Paramount
Northern Connection (Railroad ROW) Stations (West Alignment)	
TBD in next study phase	South Gate, Huntington Park, Vernon, Los Angeles
PEROW/WSAB Corridor Stations	
Bellflower Boulevard	Bellflower
183 rd Street/Gridley Road	Cerritos
Pioneer Boulevard	Artesia
Cypress College	Cypress
Beach Boulevard	Stanton
Brookhurst Street	Garden Grove
Harbor Boulevard	Garden Grove
Southern Connection (Street-Running) Stations	
Bristol Street	Santa Ana
Santa Ana Regional Transportation Center	Santa Ana
Others TBD in next study phase	Santa Ana

Figure 3.3 – Urban Rail Alternatives: Northern Alignment Alternatives

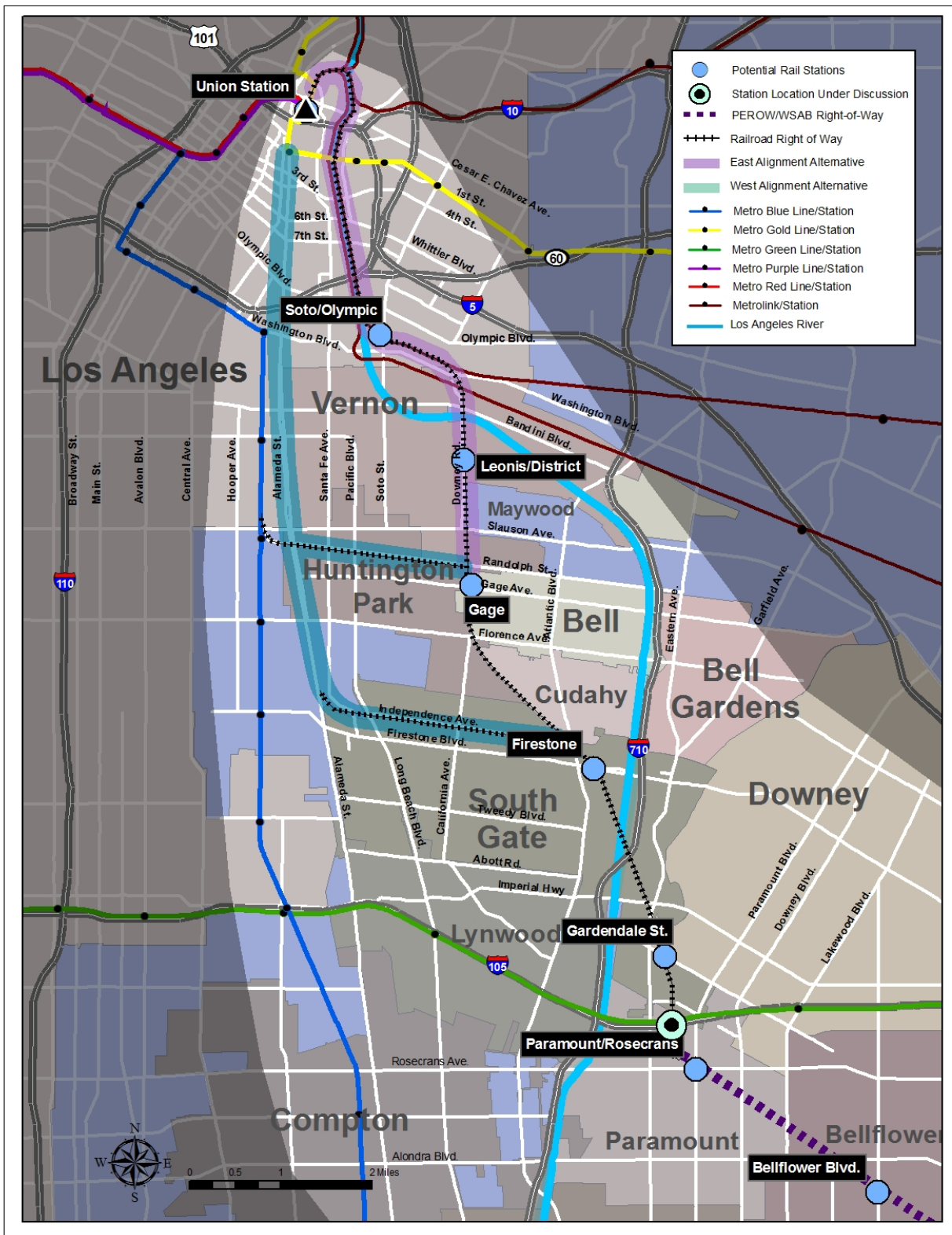
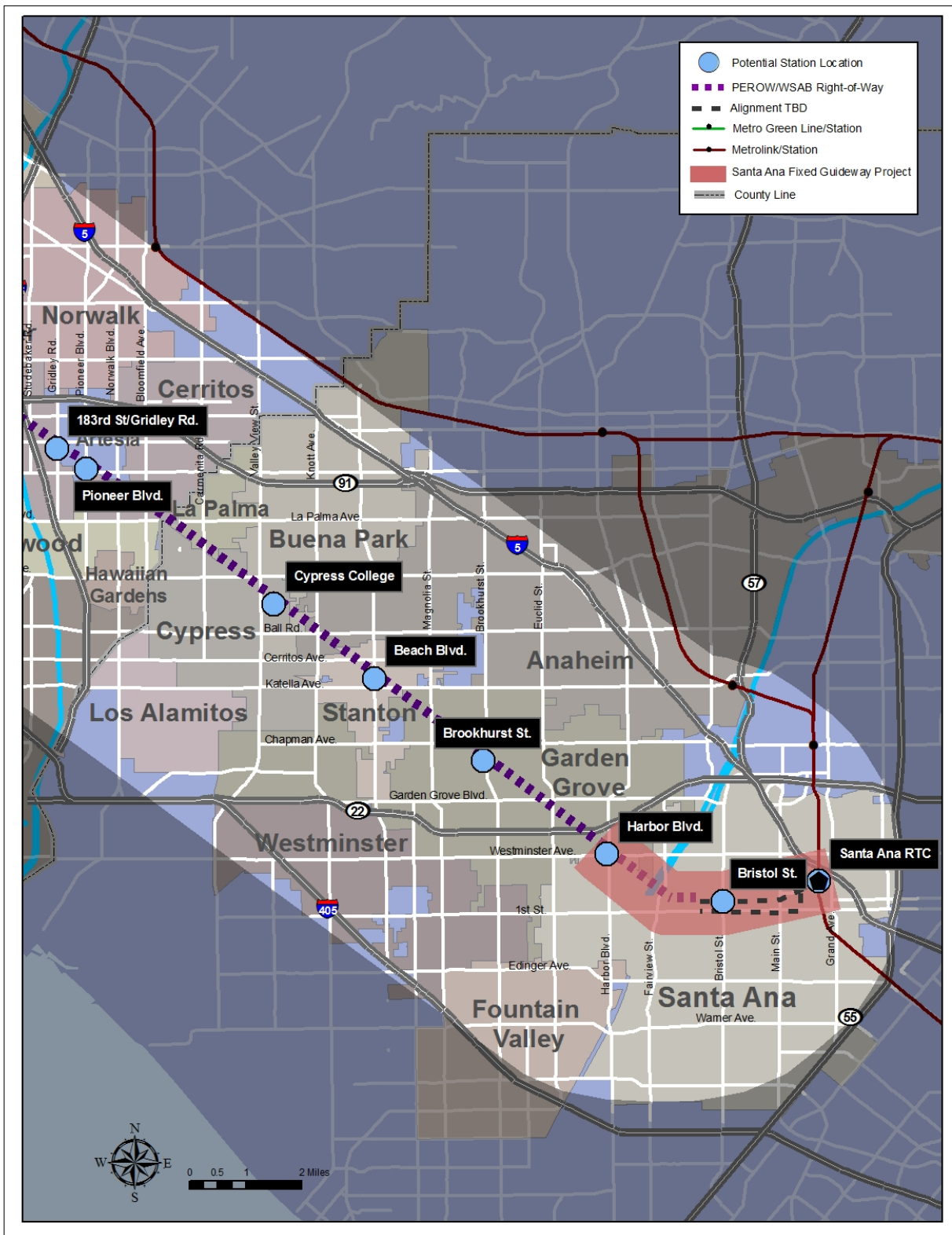


Figure 3.4 – Urban Rail Alternatives: Southern Alignment Alternatives



3.5 High Speed Service Alternatives

High speed service (HSS) is typically grade-separated and as proposed is similar to either: the conventional steel wheel HSR service operated in the U.S. by Amtrak in the Northeast Corridor, or the California High Speed Train (CHST) system currently being developed; or maglev HSS similar to systems operating in Europe and Asia. HSS speeds can range from 120 mph on upgraded track to 160 mph or faster on new track. In Europe and Asia, HSS systems operate at maximum speeds ranging from 220 to 330 mph. In the U.S., Amtrak's Acela Express operates at a maximum speed of 150 mph, and currently is the nation's only HSR service.

HSS systems have the following combination of physical and operational parameters in common:

- **Grade separation** – A majority of systems operate on ROWs that do not have any at-grade crossings with other modes, such as highways or freight rail service. In the case of existing facilities, the HSS system trackage is either moved up (built above-grade) or down (placed below-grade) to avoid at-grade crossings with other modes.
- **Exclusive right-of-way** – High speed services typically are provided with a dedicated ROW, and do not share their alignment with slower moving freight or passenger rail service.
- **Straight route** – At higher operating speeds, passenger comfort becomes a critical issue, as does maintaining the guideway's control of the vehicle. For both of these reasons, it becomes important to minimize changes in the direction of travel, and when they occur, to make them as gentle as possible. Horizontal curves must have a long radius (ranging from 2,000 to 3,000 feet depending on the technology), and vertical curves must be gradual.
- **Smooth running surface** – Whether the HSS vehicle has wheels or is levitated, passenger comfort and system operations require the construction and maintenance of a smooth running surface to minimize bumps and deviations.
- **Electrification** – Electric motors provide the rapid acceleration required to take full advantage of the operating speeds provided by HSS technology. In addition, electric propulsion operations reduce the weight of the rolling stock, as the fuel does not need to be carried aboard the train.
- **Infrequent stops** – As HSS system speed increases, so typically does the distance between stations. Wider station spacing allows the HSS service to reach and maintain its top speeds providing faster service and reduced travel times. Conversely, adding more station stops would reduce the operating speed of the HSS system and increase the travel time.

3.5.1 Conventional Steel Wheel High Speed Rail Alternative

In this study, the conventional steel wheel HSR Alternative is represented by design and operational parameters that will make it compatible with the CHST system being developed. Under the current operating parameters, the CHST system will feature trains traveling at speeds reaching up to 220 mph in flatter areas such as the Central Valley, and lower speeds to be determined in more hilly and mountainous segments, as well as urban areas. Current plans show that the HST tracks will be separated from freight and other slower passenger service to optimize service and allow for faster travel. Three CHST segments are being developed in Southern California: Palmdale to Los Angeles, Los Angeles to Anaheim, and Los Angeles to San Diego. The PEROW/WSAB ROW Corridor is not included in the CHST plan.

3.5.2 Magnetic Levitation High Speed Service Alternative

The Maglev HSS Alternative is intended to provide high speed service similar to systems operating in Asia such as the Shanghai Maglev train with travel speeds averaging 160 mph and a possible maximum speed of up to 268 mph. Maglev operations achieve “levitation” from a large number of magnets for lift and propulsion. All operational implementations of maglev technology have minimal overlap with steel wheel train technology, and are not compatible with conventional rail tracks, and because they cannot share existing infrastructure, maglev systems are designed as “complete” transportation systems.

3.5.3 High Speed Service Operational Description

The proposed HSS alignment would operate in an aerial configuration along the PEROW/WSAB ROW. Similar to the Urban Rail Alternatives, at the northern terminus of the corridor ROW terminus in the City of Paramount, the HSS alignment would turn north to operate along or above the San Pedro Subdivision through the cities of South Gate, Huntington Park, Vernon, and Los Angeles. The proposed service alignment would run north to intersect with and operate within a portion of the LOSSAN Corridor, including the east-west UP-owned ROW, and then along the north-south Metro-owned and Metrolink-operated ROW along the eastern side of the Los Angeles River. It should be noted that operations in this portion of the LOSSAN Corridor are constrained and currently operating at more than 85 percent capacity. The proposed service alignment would cross the Los Angeles River on an existing railroad bridge to operate into Union Station. The HSS options would most likely require a new bridge over the Los Angeles River, as the existing older bridge may not accommodate additional structural weight required by the HSS aerial operations, and the more gradual turning radius required by HSS. It should be noted that the current CHST connection into Union Station is being studied to occur from the UP-owned ROW, crossing the Los Angeles River near the Redondo Junction and preceding underground along the western side of the Los Angeles River and into Union Station, where the trackage is at-capacity. The CHST alignment then would proceed north to the City of Palmdale primarily utilizing the Antelope Valley Metrolink and freeway rights-of-way. The alignment options and operational requirements will be clarified and evaluated in the Final Screening phase.

Only the East Alignment Alternative was considered for the HSS Alternatives as the minimum 2,000 foot turning radius required for HSS operations would require significant property acquisition in the densely-developed cities of South Gate, Huntington Park, and Vernon through which the West Alignment Alternative would be located. In addition, the grade-separated required operations would adversely impact the adjacent primarily one- and two-story, residential neighborhoods that were built along these railroad ROWs during the 1920s and 1930s.

As shown in Figures 3.5 and 3.6, the proposed High Speed Service Alternative operates in an aerial configuration in three service alignments:

- ***Dedicated aerial lanes*** along the PEROW/WSAB Corridor ROW between the City of Paramount in Los Angeles County and the City of Santa Ana in Orange County;
- ***Railroad ROW-running aerial operations*** connecting north from the PEROW/WSAB Corridor ROW terminus utilizing railroad ROWs along the eastern side of the Los Angeles River; and

- **Street-running operations** connecting south from the corridor ROW terminus to either interface with the future Santa Ana-Garden Grove Fixed Guideway Project, or to operate along the streets of Downtown Santa Ana to the SARTC.

The preliminary set of HSS stations was identified based on previous studies and high speed service station spacing guidelines from existing HSS service and CHST service plans and is presented in Table 3.4. If either of the HSS alternatives move forward into the next study phase, the number and location of the stations will be refined based on technical analysis and input from the affected cities.

Table 3.4: High Speed Service Alternatives – Preliminary Set of Stations

Northern Connection (Railroad ROW) Stations (East Alignment Only)	
Station Location	City
Union Station	Los Angeles
New Metro Green Line Station	Paramount
PEROW/WSAB Corridor Stations	
183 rd Street/Gridley Road	Cerritos
Beach Boulevard	Stanton
Southern Connection (New Arial Station)	
Santa Ana Regional Transportation Center	Santa Ana

Figure 3.5 – High Speed Rail Alternatives: Northern Alignment

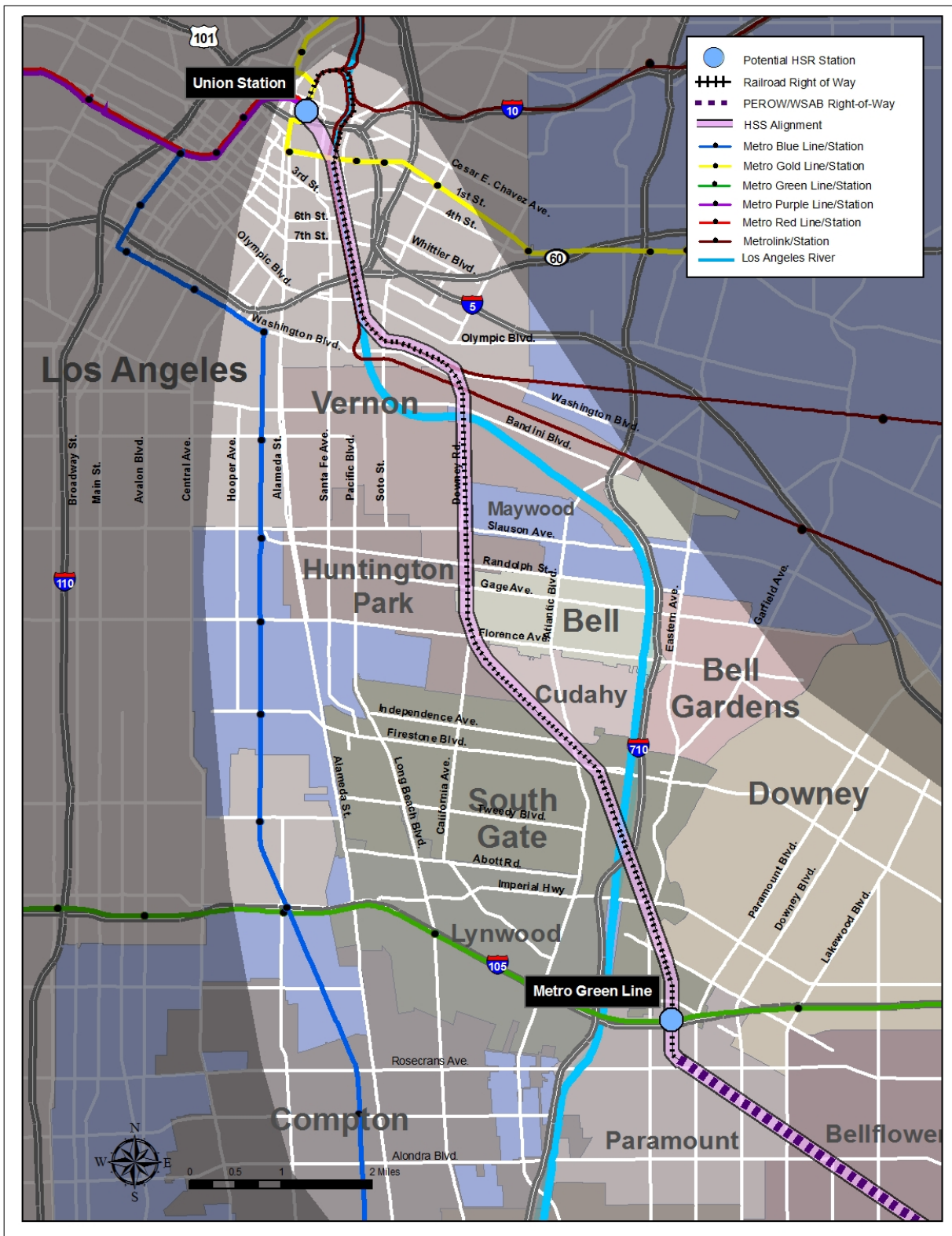
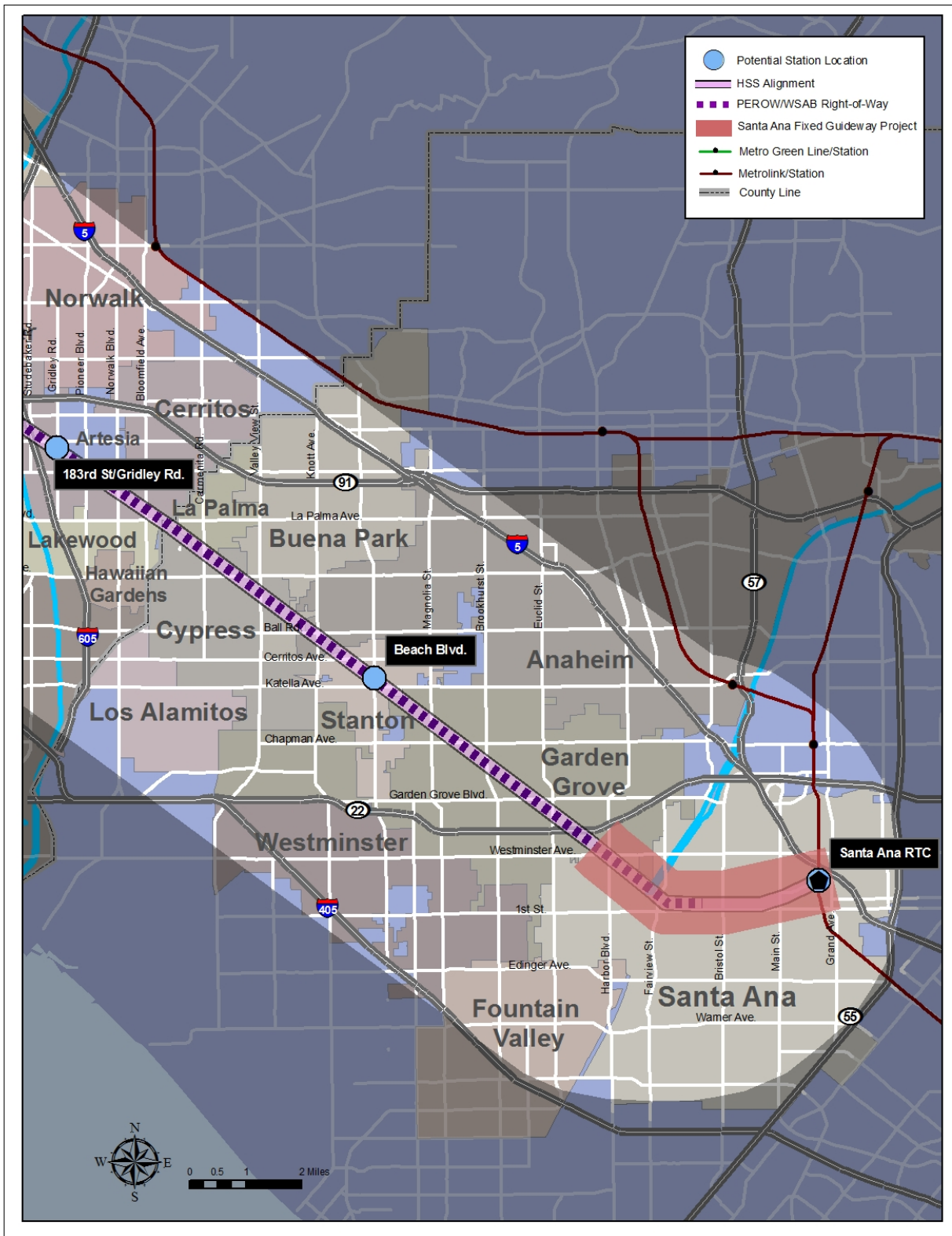


Figure 3.6 – High Speed Rail Alternatives: Southern Alignment



4.0 EVALUATION RESULTS

During the Initial Screening phase, the Initial Set of Alternatives was assessed based on a comparative analysis of technical and environmental benefits and impacts. The resulting information will provide elected officials, stakeholders, and the public with information on the benefits and impacts of the alternatives, as well as the differences between the transportation options, in order to support informed decision-making on identifying the Final Set of Alternatives for further study. Based on the resulting comparative analysis of the alternatives along with stakeholder and public input, the Initial Set of Alternatives will be refined to a smaller Final Set of Alternatives.

4.1 Initial Screening Evaluation Criteria

The Initial Set of Alternatives was evaluated based on an initial assessment of technical and environmental benefits and impacts to identify the alternatives that best meet the project goals and identified Corridor Purpose and Need, are technically viable, and have stakeholder and community support.

At this level of evaluation, technical analysis was based on order-of-magnitude information identified from the similar existing transit projects as identified below in Table 4.1. Initial evaluation efforts focused on the East Alignment Alternative for the northern connection from the terminus of the PEROW/WSAB Corridor ROW in the City of Paramount. All of the Build alternatives had this alignment into Union Station in common, and was seen as providing the most equitable comparison of the alternatives. In addition, the same station spacing was used for all of the BRT and Urban Rail alternatives to provide a balanced comparison in benefits and impacts. Analytical work was based on research, field work, conceptual engineering assessment, order-of-magnitude cost and ridership information identified from similar projects, survey of utilities and other constraints-related information, meetings with affected agencies, working sessions with city staff, and stakeholder and community input.

The Initial Screening evaluation criteria and performance measures are summarized in Table 4.2 on the following pages. The same set of comparative analysis criteria will be used for the screening of the Initial and Final Sets of Alternatives, but the specificity of the performance measures will become more detailed in the Final Screening phase as conceptual engineering and operational plans are prepared.

Table 4.1 – Existing Transit Systems used for Initial Screening Efforts

PEROW/WSAB ROW Corridor Initial Set of Alternatives	Local or Other Peer System
Bus Rapid Transit (BRT)	Metro Orange Line
Street Car	Portland Street Car
Light Rail Transit (LRT)	Metro Gold and Blue Lines
Diesel Multiple Unit (DMU)	NCTD Sprinter System
Conventional Steel Wheel High Speed Service	California HST
Magnetic Levitation High Speed Service	Asian maglev systems

Table 4.2 – Initial Screening Criteria and Performance Measures

Comparative Analysis Elements		Performance Measures	
Public and Stakeholder Support			
• Public and stakeholder support		Input from: <ul style="list-style-type: none">• Elected Official/Stakeholder briefings• Community meetings	
• City/jurisdictional support		• TAC input and Steering Committee concurrence	
Mobility Improvements			
Improve corridor mobility by increasing travel speeds and reducing travel times: <ul style="list-style-type: none">• Average travel speed• Resulting travel times• Travel time savings (compared to No Build option)		Identify possible speeds based on similar projects reflecting: <ul style="list-style-type: none">• Mode• Alignment length and vertical configuration• Alignment constraints• Other factors	
Provide connections to the regional transit system (current and future based on adopted FY 2035 LACMTA and OCTA plans) <ul style="list-style-type: none">• Minimize transfers		Conceptual assessment of linkages to: <ul style="list-style-type: none">• Metro Rail system• Metrolink system (Santa Ana RTC/Union Station)• Bus and circulator services• Major transit hubs	
Increase range of transportation options		New modal option (yes/no)	
Serve current and future travel growth and patterns		Conceptual assessment	
Serve both local and regional trips		Conceptual assessment based on: <ul style="list-style-type: none">• Station spacing	
Make transit a viable alternative: <ul style="list-style-type: none">• Resulting ridership		Alternative-specific order of magnitude ridership based on similar projects: <ul style="list-style-type: none">• Southern California/California• U.S.	
Increase access to/from corridor activity centers and destinations		Assessment based on: <ul style="list-style-type: none">• Number of activity centers served• Direct access or transfer required	
Increase service for transit-dependent corridor residents		Not evaluated at this level beyond new mode provides increased service	

Table 4.2 – Initial Screening Criteria and Performance Measures

Comparative Analysis Elements		Performance Measures	
Mobility Improvements			
Provide an integrated pedestrian and bicycle system		Initial assessment: <ul style="list-style-type: none">• Constrained right-of-way width – along Corridor, under freeways, and along railroad rights-of-way connecting north to Downtown Los Angeles/Union Station• Fit with existing and planned trail facilities• Other factors TBD	
Provide improved cross-county line transit service		Alternative connects Los Angeles and Orange counties (yes/no)	
Cost-Effectiveness/Sustainability			
Identify project costs: <ul style="list-style-type: none">• Cost to construct – capital cost per mile		Alternative-specific order of magnitude cost based on similar projects: <ul style="list-style-type: none">• Southern California/California (Metro, OCTA/NCTD)• U.S.• Rest of world	
<ul style="list-style-type: none">• Cost to operate		Alternative-specific order of magnitude cost based on similar projects: <ul style="list-style-type: none">• Southern California/California (Metro, OCTA/NCTD)• U.S.• Rest of world	
Balance project costs with expected benefits – assess cost-effectiveness		<ul style="list-style-type: none">• Annual cost per rider was identified	
Identify transportation alternatives that are financially sustainable with available resources		Compare alternative cost with committed local funding	
Land Use and Economic Considerations			
Provide station spacing that supports local economic development and revitalization plans, and job strategies		Identify local economic development/revitalization/job plans and assess: <ul style="list-style-type: none">• Alternative alignment serves plans (yes/no)• Number of proposed stations serving plans	
Serve areas with transit supportive land use policies		Identify city-based transit supportive land use policies and assess: <ul style="list-style-type: none">• Number of proposed stations with transit supportive land use policies	

Table 4.2 – Initial Screening Criteria and Performance Measures

Comparative Analysis Elements		Performance Measures	
Project Feasibility			
Minimize construction risks: <ul style="list-style-type: none">• Perform constructability review<ul style="list-style-type: none">- Identify and assess engineering constraints and challenges- Develop conceptual-level engineering solutions		Identify engineering constraints and challenges: <ul style="list-style-type: none">• Constrained right-of-way width – along corridor ROW and under freeways• Encroachments (public and private) on ROW• Utility issues – overhead, along ROW, underground• Flood channel issues – along the ROW (Los Angeles County) and channel crossings/new bridges (U.S. Army Corps of Engineers)• Interface with Metro Green Line• Interface with Santa Ana-Garden Grove Project• Fit with Metrolink and freight rail operations• Fit with CAHST plans	
Develop constructible, operable plans: <ul style="list-style-type: none">• Identify and assess connections beyond the corridor right-of-way<ul style="list-style-type: none">- Northern Connection: freight rail compatibility or other operational configurations- Southern Connection: fit with future Santa Ana-Garden Grove Fixed Guideway Project		Identify viable northern alignments and assess conceptual ability to assess: <ul style="list-style-type: none">• Freight rail “envelope” (size of operating and maintenance equipment)• Railroad ROW constraints• Feasibility of shared or separate tracks• FRA crash-compliant vehicle issues Identify and assess southern connections: <ul style="list-style-type: none">• Study timing• Fit with modes under consideration – Rail and highway• Resulting corridor ROW constraints• Operational impacts – same mode/interlined service, transfer required, or operate in separate configuration	
Identify Minimal Operable Segments		Preliminary assessment at this level – possible (yes/no)	
Develop and assess operating plans: <ul style="list-style-type: none">• System capacity• Operating constraints		<ul style="list-style-type: none">• Conceptual capacity identified based on proposed vehicles and future year agency operating policies	
Evaluate implementation viability: <ul style="list-style-type: none">• Identify and assess fit with probable operator’s system and operational plans, service standards, and criteria• Represents viable “shovel-ready” technology• Consider U.S. “Buy American” requirements (FTA and FRA)		Preliminary identification and assessment of: <ul style="list-style-type: none">• Probable service operators, modal fit with system, operational and adopted plans, service standards and criteria, and funding capabilities• Viable technology<ul style="list-style-type: none">- Existing operating system in U.S.- System in design/under construction in U.S.• Can meet FTA/FRA “Buy American” requirements	

Table 4.2 – Initial Screening Criteria and Performance Measures

Comparative Analysis Elements		Performance Measures
Environmental Impacts and Benefits		
Minimize environmental and community impacts		Assess initial impacts for following key issues identified by stakeholders and the public: <ul style="list-style-type: none"> • Noise and Vibration • Visual and Privacy • Traffic Impacts – such as grade crossings and intersection/signal synchronization operations • Property acquisition • Other issues TBD that differentiate between the alternatives
Improve air quality by reducing tailpipe and Greenhouse Gas emissions		Modal comparison of air quality impacts based on similar projects Consultation with SCAQMD
Provide for safety and security of pedestrians, bicyclists, and transit users		Initial assessment of probable impacts based on similar projects
Assess environmental justice impacts – identify and analyze distribution of project construction and operational effects based on income and race/ethnicity		Areas of concern not identified at this level

4.2 Public and Stakeholder Support

Public and stakeholder input on the Initial Screening results, along with city and jurisdictional comments, were solicited through the following efforts:

- **Project Advisory Committees** – Technical Advisory Committee (TAC), comprised of city and agency representatives, and the Steering Committee, comprised of elected officials. TAC meetings were held in October 2010, and January, February, March, and April 2011. Steering Committee meetings were held in November 2010, and February and April 2011.
- **Elected Official and Stakeholder Briefings** – One-on-one briefings of elected officials and stakeholders were conducted October-December 2010, and January-April 2011.
- **City and jurisdictional communications**, including emails and letters, were provided between September 2010 and March 2011.
- **Community Meetings** – A series of six community meetings were held at locations throughout the Corridor Study Area during October and November 2010.
- **Public Presentations** to community and stakeholder groups from September to November 2010.
- **Public Comments** received through phone calls, emails, letters, and response cards.

All received input was documented, summarized, and presented to the Steering Committee, who is charged with developing recommendations for a Final Set of Alternatives.

4.3 Mobility Improvements

During Initial Screening, the **horizontal alignments** were the same for all of the alternatives, except for the BRT Alternative which has both a street-running and a freeway-running alignment. The street-running alignment, which has the most similar routing to the other alternatives, was used for this level of analysis.

The **vertical alignments**, or whether the alternative operates at-, above-, or below-grade, was evaluated based on the entire alignment of each alternative running at-grade or grade-separated for each alternative as presented previously in Table 3.1. It should be noted that there were two exceptions to the analysis: high speed service requires grade-separation for operational and safety reasons; and BRT and DMU typically are not operated in a below-grade or subway configuration due to safety concerns related to diesel fuel ventilation issues, though recent technological advances have reduced impacts.

The range in travel speeds achieved by the Initial Set of Alternatives was based on the speeds provided by transit systems currently in operation in similar urban settings to those in the PEROW/WSAB Corridor Study Area. The alternative speeds presented below in Table 4.3 reflect the following factors:

- **Station spacing** – Reflects the role each alternative plays, whether community- or regional-trip oriented, agency operational standards, and community needs. During Initial Screening efforts, stations were identified in each city, at an average spacing of two-miles apart, for the BRT and Urban Rail alternatives to provide a balanced comparison in benefits and impacts. The station spacing for the HSS options was approximately six miles to better serve PEROW/WSAB Corridor needs; typical high speed service station spacing would have resulted in the approximately 34-mile long corridor having one station in addition to the northern and southern terminus stations.
- **Operational capabilities** – The average and maximum speeds that the vehicle and system are designed to operate at, and the optimal station spacing to allow each alternative to operate at its optimal operational capabilities.
- **Mode-specific design requirements** – Each alternative has design requirements, such as turning radius guidelines, which may require a speed reduction to accommodate passenger comfort and vehicle operational needs. At higher operating speeds, passenger comfort becomes a critical issue, as does maintaining control of the vehicle. For both of these reasons, horizontal curves for HSS systems must have a long radius and vertical curves must be gradual, which results in slower speed segments at alignment transition points.
- **At-grade or grade-separated operations** – Transit systems running in ROW- or grade-separated conditions can operate at a higher speed than those in at-grade operations, which must operate in reduced speeds to reflect traffic operating speeds, and pedestrian and vehicular safety concerns.

Table 4.3 – Initial Screening Travel Speeds (Miles Per Hour)

Vertical Configuration	BRT	Streetcar	LRT	DMU	High Speed	
					Conventional	Maglev
At-Grade	10-14	8.5-15	25-35	25-35	--	--
Grade-Separated/ Separate ROW	25-35	25-40	45-55	45-55	110-220	150-270+

An overview of the resulting mobility improvements provided by the Initial Set of Alternatives is presented below in Table 4.4. In summary, all of the Initial Set of Alternatives address and meet the following Mobility Improvement criterion:

- ***Increase the range of transportation options.***
- ***Serve current and future travel growth and patterns.***
- ***Provide connections to the regional transportation system*** as identified by the current and future based on the Long Range Transportation Plans adopted by Metro and OCTA.
- ***Provide improved linkages*** to the Los Angeles County Metro Rail system and increase access to the Metrolink system for Corridor Study Area residents.
- ***Minimize transfers*** by providing end-to-end Corridor Study Area service at this level of analysis. Reuse of a portion of the PEROW/WSAB Corridor ROW is being studied through the Santa Ana-Garden Grove Fixed Guideway (SAGGFG) study, which has recommended street car service. For the Street Car Alternative included in this AA study, there is an opportunity to interline service (operate both street car systems on the same track), but all of the other alternatives will require a transfer between the PEROW/WSAB and SAGGFG systems. There is a possibility of designing the PEROW/WSAB system to operate over, or beside the SAGGFG system, if not precluded by the use of the ROW for ramps connecting to and from the SR-22 Freeway.
- ***Increase access to corridor activity centers and destinations.***
- ***Increase service for transit-dependent corridor residents.***
- ***Provide an integrated pedestrian and bicycle system.*** All of the alternatives could provide an integrated pedestrian and bicycle system along large segments of the Corridor Study Area, but initial field visits have identified physical ROW width constraints related to freeway undercrossings and sharing of existing freight rail ROWs that may preclude provision of these facilities in some locations.

Differences in mobility improvement areas between the alternatives include the following:

- ***Serve major transit hubs*** – Currently, the major Corridor Study Area transit hubs are located at Union Station and the Santa Ana Regional Transportation Center, with a minor transit hub providing mid-corridor access to the Metro Rail system at the Metro Green Line Lakewood Boulevard Station. All the alternatives provide connections to Union Station and SARTC at this point in the study. The Urban Rail and High Speed Service alternatives may not provide a connection to the Metro Green Line Lakewood Boulevard Station, but rather may serve a new Metro Green Line station located to interface with the currently Ports-owned ROW to the west of the Lakewood Boulevard Station. It should be noted that the future transportation systems provided by each of the alternatives will result in the creation of new transit hubs with connecting bus and circulator service.
- ***Improve travel speeds over current transit and auto travel speeds*** – As shown below in Table 4.4, not all of the alternatives will provide improved average travel speeds, but still may provide improved travel times due to the ability to run in dedicated operations along the PEROW/WSAB ROW. As identified by stakeholders and the public, the two criterion used to determine whether an alternative improves travel speed were: average Metro Blue Line travel speed (25 mph); and average peak period freeway travel speed (used the current and forecast 2035 peak period for the I-5 Freeway, which is 50 to 60 percent and 90 to 100 percent of peak period travel at 35 mph or less respectively).

- **Serve both local and regional trips** – As presented below, the BRT and Street Car alternatives more typically serve local trips, while the LRT and DMU options serve both local and regional trips, and the High Speed Service alternatives serve regional trips. It should be noted that, depending on station spacing, operational, and vehicle selection decisions, the BRT and Street Car options can operate at speeds approaching at-grade LRT service, allowing these alternatives to potentially serve both local and regional trips.

Table 4.4 – Overview of Resulting Mobility Improvements

Criteria	BRT	Streetcar	LRT	DMU	High Speed Service	
					Conventional	Maglev
Trip Purpose	Local Regional ¹	Local Regional ¹	Local Regional	Local Regional	Regional	Regional
Increase access to/from corridor destinations	Yes	Yes	Yes	Yes	Yes	Yes
Average Station Spacing (miles)	0.5-1.0	0.2-0.5	1.0-1.5	1.5-3.0	10-20	10-20
Average Travel Speed (mph)	22	12	30	30	90	90
Improve Travel Speed (Over rail and peak period I-5 Freeway speed of 25-35 mph)	No ¹	No ¹	Yes	Yes	Yes	Yes
Improve Travel Time	TBD ¹	TBD ¹	TBD ¹	TBD ¹	Yes	Yes
Number of Transfers Union Station-SARTC	0	0	0	0	0	0
Connect to Metro Rail System	Transfer	Transfer ²	Opportunity to interline Service	Transfer	Transfer	Transfer
Connect to Metrolink System	Transfer	Transfer	Transfer	Transfer	Transfer	Transfer
Number of Transfers to future CAHST System	1	1	1	1	0	1

¹ Depends on factors including station spacing, operational decisions, and vehicles selected.

² Opportunity to interline service with future Santa Ana-Garden Grove Fixed Guideway System.

4.3.1 Conceptual Daily Boardings

At this level of evaluation, a range of conceptual daily boardings was identified for each of the alternatives based on a three step process. The first step was to identify ridership for projects currently in operation in similar Southern California settings. Both current daily ridership and forecasted future year ridership was identified for each of the peer systems and is presented below in Table 4.5. To reflect

the conceptual level of the analysis, a range of possible ridership was identified based on a combination of the transit lines' ridership to reflect the different population and employment densities of the Corridor Study Area. The portion of the study area generally located above the I-105 Freeway has a densely-populated, urban setting with a high level of low-income and transit-dependent households, and represents approximately 40 percent of the study area. The southern portion, comprising a larger portion of the study area (60 percent), is more suburban in character with a lower population and employment density, and fewer transit-dependent households. For the BRT Alternative, Metro Rapid service information represents the northern portion of the study area that it currently serves, while the communities that are served by the Metro Orange Line are similar in character to the southern portion of the Corridor Study Area. For the Urban Rail alternatives, Metro Blue Line ridership best represents the northern portion of the study area that it currently serves, while the communities served by the Metro Gold Line are similar in character to the southern portion of the study area.

As shown in Table 4.5, the BRT conceptual ridership numbers are based on a combination of:

1. The Metro Orange Line only;
2. A combination of the Metro Orange Line (60 percent), and Metro Express Bus Route 460 (40 percent) that currently provides freeway service connecting Downtown Los Angeles and the City of Anaheim via the I-110 and I-105 freeways, which would reflect the freeway-running BRT Alternative; and
3. A combination of the Metro Orange Line (60 percent) and Metro Rapid Lines 751 and 760 (40 percent) that provided service in the northern section of the study area, which is similar to the proposed street-running BRT Alternative.

For the Urban Rail Alternatives, the conceptual range of ridership was represented by:

1. The Metro Gold Line; and
2. A combination of the Metro Gold Line (60 percent), which reflects the Corridor Study Area population density south of the I-105 Freeway; and the Metro Blue Line, which best represents the Study Area population north of the I-105 Freeway.

Table 4.5 – Peer System Ridership

Initial Set of Alternatives	Peer System	Line Length	Number of Stations	Current Daily Riders (2009/2010)	Metro Model Ridership Forecast (2035)
Bus Rapid Transit	Metro Orange Line	14	14	21,700	44,700
	Metro Orange Line (60%) and Route 460 (40%)	20	20	14,800	28,900
	Metro Orange Line (60%) and Rapids 751/760 (40%)	20	30	19,200	34,300
Urban Rail	Metro Gold Line	20	21	34,300	46,300
	Metro Gold (60%) and Metro Blue Line (40%)	20	20	53,000	69,700
High Speed Service	Pacific Surfliner	350	29	7,100	NA

For the High Speed Service Alternatives, Amtrak's Pacific Surfliner service providing inter-city service between Union Station in Downtown Los Angeles and the SARTC in Santa Ana was identified as the most representative peer system.

In the second step, as presented below in Table 4.6, the peer system ridership information was factored to represent the proposed alignment length and number of stations per each corridor alternative, and two estimates were identified to bracket the possible ridership:

1. **Estimate 1** was based on current ridership; and
2. **Estimate 2** reflected forecasted ridership for 2035 from the Metro Model.

In the third step, the resulting conceptual ridership numbers provided by the two estimates were averaged, and two resulting estimates were identified to provide order-of-magnitude ridership representing daily boardings:

1. **A low estimate** reflecting 20 percent less ridership than the identified average; and
2. **A high estimate** (representing a 20 percent increase over the estimate).

Table 4.6 – Order-of-Magnitude Ridership Estimates

Modes	Line Length	Stations	Estimate 1 (Current Riders)	Estimate 2 (Future Riders)	Average (Of 1 and 2)	Low Estimate	High Estimate
Bus Rapid Transit	32.5	16	30,000	24,000	27,000	21,600	32,400
	32.5	16	20,000	28,000	24,000	19,200	28,800
	32.5	16	21,000	28,000	24,500	19,600	29,400
Urban Rail	32.5	16	32,000	33,000	32,500	26,000	39,000
	32.5	16	51,000	45,000	48,000	38,400	57,600
High Speed Service	32.5	5	4,000	NA	4,000	3,200	4,800
	32.5	4	3,000	NA	3,000	2,400	3,600
	32.5	3	2,000	NA	2,000	1,600	2,400

The resulting range of order-of-magnitude daily boardings for each alternative is presented below in Table 4.7. The following factors should be noted for each alternative:

- **Bus Rapid Transit (BRT) Alternatives** – During the Initial Screening phase, only the East Alignment street-running alternative was analyzed and the proposed set of stations reflected current Metro Rapid station spacing. In the next study phase, station spacing in this alignment segment may be revised to reflect wider BRT-spacing, which would result in a faster travel time and higher ridership.
- **Urban Rail Alternatives** – Only the East Alignment Alternative was evaluated at this point. The approximately two-miles station spacing may be revised depending on the Urban Rail option.
- **High Speed Service Alternatives** – During Initial Screening, only the East Alignment Alternative was evaluated for the two high speed service options.

Table 4.7 – Order-of-Magnitude Daily Boardings

	BRT	Urban Rail	High Speed Service
Conceptual Ridership	19,200 – 32,400	26,000 – 57,600	2,400 – 4,800

4.4 Cost to Build and Operate

Conceptual order-of-magnitude capital and operating and maintenance cost estimates, along with current fares for similar systems and a conceptual annual cost per rider, were identified for the Initial Set of Alternatives. Unit costs were identified based on the similar existing projects identified above in Table 4.1 and as discussed below in each cost category.

4.4.1 Capital Costs

Capital costs are the expenses associated with the design and construction of the proposed alternatives, and they fall into two categories:

1. **Construction Costs** – including guideway and track elements; stations, parking structures and station access elements (elevators and escalators); maintenance and storage facilities; site work (demolition and utility work); and system equipment such as train control, signals and crossing protection, traction power substations, and traction power distribution.
2. **Total Project Costs** – acquisition of land and/or right-of-way; purchase of vehicles and provision of professional services, including engineering, project and construction management; insurance; permits; surveying and testing; and finance charges.

Conceptual order-of-magnitude capital costs were developed by estimating the quantities on a per miles basis for individual line items required to build and operate each alternative based on single-line engineering drawings and similar projects, and then by applying standardized unit costs. The unit costs used in preparing the capital cost estimates were derived primarily from similar Metro and other projects with recent construction bid information or detailed preliminary engineering-related cost estimates. The capital costs were derived by multiplying the unit costs by the quantities such as length of the track and number of stations. A capital cost for each alternative was compiled in Standardized Cost Categories (SCC), developed by the FTA for comparing project costs on a national basis.

Contingencies were applied to the unit costs as a percentage of the category, and then included to develop the total project cost for each alternative. The contingency percentages were identified based on past Metro projects. When performing any cost estimate, especially at this conceptual level of design, unforeseen costs arise due to circumstances beyond the defined scope of work. Contingencies provide a way to account for unforeseen costs due to: items that are not definable at this level of design; and unforeseen costs arising when the project is under construction.

Alternative-specific conceptual order of magnitude capital estimates were developed for the project from Union Station to the Santa Ana Regional Transportation Center and all costs are in 2010 dollars. As discussed above, capital costs were identified for three vertical configurations: all at-grade, above-grade (aerial), and below-grade (subway). Capital costs for the No Build and TSM alternatives will be developed in the next phase. No Build capital costs will be based on the Corridor Study Area projects to

be completed by 2035 as identified in the Metro and OCTA LRTP. Projects to be included in the TSM Alternative will be identified with Metro and OCTA, and reflect their future capital cost projections. Alternative-specific cost methodologies and assumptions are discussed below. It should be noted that the capital cost estimates presented below in Table 4.8 include a placeholder cost for the construction of an incremental storage and heavy maintenance facility required for each alternative to support operations.

The cost methodology for the BRT and Urban Rail alternatives had the following elements in common:

- Assumed the alignment along the eastern side of the Los Angeles River of 33.5 miles in length (generally 60 percent in Los Angeles County and 40 percent in Orange County), and 16 stations (6 in Orange County and 10 in Los Angeles County).
- Capital costs were broken into: construction costs, vehicles, ROW, and professional services.
- Construction costs were broken into: guideway, stations, support facilities (maintenance and storage yard), sitework, and systems.
- Contingencies used: 30 percent on capital costs, five percent on vehicles, and 15 percent to soft costs (professional services including financing costs, legal fees, surveying, permitting, and insurance costs).

The cost methodology for the Urban Rail and High Speed Service alternatives has the following alignment segments in common:

- Assumed the use of the PEROW/WSAB Corridor ROW, along with a placeholder for a ROW connection north to Union Station, and south to the Santa Ana Regional Transportation Center.

The BRT cost methodology was based on the following:

- Assumed use of the PEROW/WSAB Corridor ROW; north of the Metro Green Line, the BRT option operates in city streets after leaving the northern end of the ROW; and south of the terminus in the City of Santa Ana, this alternative operates in city streets, after the ROW ends
- Assumed construction of a 28-foot wide asphalt road with a six foot shoulder along the PEROW/WSAB Corridor ROW.
- Unit prices were identified from Metro Orange Line Extension Project.

The Street Car cost methodology was based on the following:

- Unit prices were identified from Metro Project Estimates, the Sacramento Street Car Study Draft EIR, and the Portland Street Car EIR.
- Capital costs were similar to the LRT Alternative with the following exceptions: track and fixed guideway section costs are less expensive due to a lighter vehicle weight, and power systems are less expensive as Operating Control System (OCS) poles are not required.

The LRT cost methodology was based on unit prices identified from Metro Project Estimates.

The DMU cost methodology was based on the following:

- Unit prices were identified from the NCTD Sprinter Project in San Diego County, and the Eastside Gold Line Extension LRT Project Estimates for items not included in the Sprinter Project.

- Capital costs were similar to the LRT Alternative with the following exceptions: no catenary and OCS poles are required, while the maintenance facility costs are higher due to the requirement for new diesel fuel storage and vehicle refueling facilities.

The Conventional Steel Wheel HSS Alternative cost methodology was based on the following:

- Assumes the alignment along the eastern side of the Los Angeles River, 33.5 miles in length, and five stations, two in Orange County and three in Los Angeles County.
- Unit prices were identified from the following sources:
 - SCAG HSR and Maglev reports for Capital Costs and Operating Costs prepared as part of the *High Speed Regional Transportation System Alternatives Analysis, July 2009*.
 - SCAG Maglev Deployment Program Refined Cost Estimate, July 2006.
 - California High Speed Rail *San Francisco to San Jose Draft EIR/EIS Capital Costs, Appendix L, August 05, 2010*.
- Major cost factors reflected in HSS Steel Wheel Alternative cost estimate:
 - ROW takes for alignment – more than 100 parcels;
 - Aerial guideway – 33.54 miles plus tail tracks; and
 - Aerial station cost of \$25 million.

The cost methodology effort diverged from SCAG Maglev Report in the following ways:

- Did not discount contingency cost to guideway structure – utilized 30 percent contingency similar to other construction system elements. The contingency is required to reflect the variability in raw materials costs, and unforeseen construction costs at this conceptual level of estimate. Also, Maglev is a new technology in Southern California, and precast guideways have not been implemented due to seismic issues.
- Report costs were not consistent with current practices and were updated.

The Maglev HSS Alternative cost methodology was similar to the HSS Steel Wheel Alternative with the following exceptions:

- Major cost factors reflected in Conventional Steel Wheel HSS Alternative cost estimate:
 - Vehicle costs – \$64.1 million per train set (compared to \$30 million for the Conventional Steel Wheel HSS Alternative; and
 - Linear guideway motors are 10 times more expensive than OCS Traction Power System required for the Conventional Steel Wheel HSS Alternative.

The resulting order of magnitude capital costs for the Initial Set of Alternatives are presented below in Table 4.8. As may be expected the at-grade alternatives have the lowest costs, with the BRT Alternative identified to cost the least among the alternatives. It should be noted that buses have a 10 to 15 year lifecycle versus 30 years for rail vehicles, and the initial capital investment in buses would have to be repeated in the future. The identified capital cost for the BRT Alternative does not include future bus replacement costs.

Table 4.8 – Conceptual Order-of-Magnitude Cost to Build (Millions, 2010\$)

	BRT	Street Car	LRT	DMU	High Speed Service	
					Conventional	Maglev
At-Grade	\$ 605.5	\$1,305.1	\$ 1,598.1	\$1,222.4	--	--
Above-Grade	\$2,176.1	\$3,955.7	\$ 4,212.8	\$4,108.0	\$ 4,918.0	\$ 5,942.7
Below-Grade	--	\$9,813.3	\$10,612.5	--	\$13,353.6	\$14,013.2

For the Urban Rail options, the capital costs vary by \$376 million with the DMU Alternative estimated to cost the least (due to no electrical catenary and traction power substation system expenses) at two times the cost of the BRT Alternative. The Street Car Option would cost \$83 million more than the DMU, and the LRT Alternative is the highest cost at \$376 million more than the DMU. It should be noted that the LRT Alternative provides four times the carrying capacity of the BRT Alternative, almost eight times the Street Car Alternative, and two times the DMU Alternative. No at-grade costs were identified for the High Speed Service options as operations require grade separation in order to achieve higher speed and address pedestrian, vehicle, and slower rail traffic safety concerns.

Among the above-grade running options, construction of an aerial BRT Alternative is estimated to cost the least, but still is estimated to be 3.6 times the at-grade BRT system cost. For the Urban Rail alternatives, the Street Car Alternative is estimated to cost the least primarily due to lighter vehicles requiring less structure. The aerial DMU Option is second lowest in cost at 2.7 times the at-grade DMU option, and the LRT Alternative is the highest at 3.4 times the at-grade LRT system cost.

Among the High Speed Service Alternatives, the order-of-magnitude cost for the Maglev Option is \$1 billion more than the estimated cost for the Conventional Steel Wheel option primarily due to more costly vehicles and, as noted above, the linear guideway motors required for maglev operations are 10 times more expensive than the OCS Traction Power System required for the HSS Steel Wheel Alternative. In addition, Maglev systems typically are more expensive to build because the “track” bed has to be perfectly smooth, and construction tolerances are very tight to maintain levitation and guideway control when compared to the Conventional Steel Wheel HSS Alternative.

There are significant construction costs related to the implementation of below-grade operations. At a conceptual, order-of-magnitude capital cost level, the Street Car Alternative was estimated to cost the least, but still is estimated to be 7.5 times the cost of the at-grade Street Car system option and 2.5 times the aerial system option. Among the High Speed Service Alternatives, the Conventional Steel Wheel HSS Alternative was identified as less costly than the Maglev HSS Option. No below-grade costs were identified for the BRT and DMU options as they typically are not located in an underground configuration due to ventilation issues.

Table 4.9 presents a breakdown of the conceptual capital costs by county. Generally the capital costs breakdown into 60 percent for Los Angeles County and 40 percent for Orange County, as more of the alignment length and stations are located within the Los Angeles County portion of the study area. The only exception is the BRT Alternative where a majority of the Los Angeles County alignment would be

street-running, since it exits the northern end of the PEROW/WSAB Corridor ROW at the City of Paramount, resulting in lower capital costs.

During the next study phase, the most effective and appropriate vertical alignments will be identified based on conceptual level engineering and traffic analysis, and working sessions with the cities along the alignments. In initial discussions, some cities identified their desire for at-grade operations, while others preferred grade-separation of any future transportation system. The resulting system most likely will have a combination of at-grade and grade-separated operations.

Table 4.9 – Conceptual Order-of-Magnitude Cost to Build by County (Millions, 2010\$)

Vertical Alignment	County	BRT	Street Car	LRT	DMU	High Speed Service	
						Conventional	Maglev
At-Grade	Los Angeles	\$ 235.2	\$ 765.1	\$ 987.2	\$ 735.5	--	--
	Orange	\$ 370.3	\$ 540.0	\$ 610.9	\$ 486.9	--	--
	Total	\$ 605.5	\$1,305.1	\$1,598.1	\$1,222.4	--	--
Above-Grade	Los Angeles	\$ 724.1	\$2,378.3	\$2,466.8	\$2,406.2	\$ 2,994.7	\$ 3,641.4
	Orange	\$1,452.0	\$1,577.4	\$1,746.0	\$1,701.8	\$ 1,923.3	\$ 2,301.3
	Total	\$2,176.1	\$3,955.7	\$4,212.8	\$4,108.0	\$ 4,918.0	\$ 5,942.7
Below-Grade	Los Angeles	--	\$5,707.2	\$ 6,322.0	--	\$ 7,952.7	\$ 8,028.7
	Orange	--	\$4,106.1	\$ 4,290.5	--	\$ 5,400.9	\$ 5,984.5
	Total	--	\$9,813.3	\$10,612.5	--	\$13,353.6	\$14,013.2

4.4.2 Operating and Maintenance Costs

Operating and maintenance (O&M) costs are related to the day-to-day operations of the proposed transportation service including labor, vehicle maintenance and overall transit facility maintenance. Alternative-specific order of magnitude operating cost per service hour was identified based on the following:

- **BRT** – Metro Orange Line and Metro Rapid operational costs;
- **Street Car** – Portland Street Car Operating and Maintenance Division;
- **LRT** – Metro Eastside Phase 2 Preliminary Operating Costs Technical Memorandum;
- **DMU** – NCTD operating costs; and
- **High Speed Service** – SCAG *High Speed Regional Transportation Alternatives Analysis* which identified operating costs as being within five percent for Steel Wheel and Maglev systems, with Maglev typically costing less as this option does not have “track wear.”

As shown below in Table 4.10, the resulting O&M costs are presented in a range reflecting at-grade versus grade-separated costs. At-grade operations are more costly due to many factors, including the stop-and-go impacts on street-running vehicles, and the impacts on at-grade rail tracks being crossed by other vehicles. Urban rail alternatives are more costly than rubber-tired options due to the need for on-going steel guideway maintenance. Street Car operations are less costly than LRT service partially due to

smaller vehicles and less complex catenary systems, while the DMU alternative is more costly than the LRT option due to clean diesel delivery, storage, vehicle refueling requirements, and maintenance crew costs. While High Speed operating costs appear significantly higher than the other options, it should be noted that this service option was developed to compete with air travel that typically has a \$5,000 to \$10,000 cost per service hour, making it a cost-effective alternative.

Table 4.10 – Order-of-Magnitude Operating and Maintenance Cost Per Service Hour

	BRT	Street Car	LRT	DMU	High Speed Service
Cost Per Service Hour	\$80–120	\$140–150	\$160–250	\$250–300	\$2,500–3,000

4.4.3 Cost to Ride

During Project Initiation, community meeting participants identified that the cost to ride any system resulting from the AA study was an important decision-making factor. Many felt that the system should be affordable for older adults and students, and that it should offer an attractive price compared to driving a car.

Table 4.11 below presents the current (2010) fare per one-way trip for each of the proposed alternatives based on a similar service type and travel distance. As there is no High Speed Service currently operating in California or on the West Coast, the Acela high speed service operated by Amtrak in the corridor between Boston and Washington, D.C. was used. The distance between the cities of Baltimore and Washington, D.C. is of a comparable distance as a corridor end-to-end trip, so the identified Acela fare was for this city-to-city trip. A range is presented because the fare is time-sensitive and varies from \$57 and \$63 during peak periods to \$50 in the early evening and \$38 after 9:00 PM. Non-high speed rail service for the same trip is \$26 to \$29 in peak periods, and \$21 after 8:00 PM. Even with the price difference, weekday peak period Acela trips are frequently sold out.

In the next phase, total daily service hours will be identified based on proposed service schedules. For example, the Metro LRT service span is basically 4:00 AM to 1:00 AM for weekday and weekend service, or 21 daily service hours. Cost per service hour also is impacted by service frequency, such as peak service every four minutes versus non-peak service of every 12 minutes, which also will be conceptually developed during the Final Screening phase.

Table 4.11 – Current Fares for Similar Systems (2010\$)

	BRT	Street Car	LRT	DMU	High Speed Service
Comparable System	Metro Orange Line	Portland Street Car	Metro Gold Line	NCTD Sprinter	Amtrak Acela
Fare Per One-Way Trip	\$1.50	\$2.05	\$1.50	\$2.00	\$38–63

4.4.4 Annual Cost Per Rider

One of the key performance metrics considered by the FTA in determining the viability of proposed projects is cost-effectiveness, which compares project costs (both capital and operating) to expected benefits. Cost-effectiveness can be more easily understood as the annual cost incurred to save a transit rider an hour of travel time. The identified “net new transit riders” includes all transit riders, whether bus or rail patrons. As may be expected, the lower the incremental cost per new transit rider, the more cost-effective the project alternative. Generally, a project seeking federal funding must have a cost-effectiveness index (CEI) of under \$25.

Calculating an alternative-specific CEI requires detailed capital and operating costs, along with forecast ridership information from travel demand model runs, which are not available at this point in the AA process. During Initial Screening, the conceptual annual cost per rider was identified to provide a comparative analysis between the alternatives. The cost per rider was calculated based on order-of-magnitude capital and operating costs compared with conceptual level ridership. Capital costs were based on taking the conceptual capital cost and dividing it by a project lifecycle established by FTA. Typically, a bus project has a 10-15 lifecycle, and while rail systems cost more initially, but they have a longer vehicle lifecycle of 20-30 years. The resulting range of costs presented below in Table 4.12 reflects the corresponding range in capital costs – at-grade versus grade-separated – and the range in conceptual ridership. While not directly comparable, several of the options appear able to meet FTA CEI requirements depending on final design and operational decisions and resulting ridership.

Table 4.12 – Conceptual Annual Cost Per Rider (2010\$)

BRT	Street Car	LRT	DMU	High Speed Service	
				Conventional	Maglev
\$20–50	\$10–40	\$10–50	\$10-50	\$460–920	\$580–1,150

4.5 Land Use and Economic Considerations

During Project Initiation efforts, corridor stakeholders and the community expressed their desire that any future transportation investment provide station spacing that supported local economic development and revitalization plans, and job strategies. Working sessions were held with the corridor cities to identify land use and revitalization plans. As presented in Table 4.13, many corridor cities had anticipated the reuse of the PEROW/WSAB Corridor ROW based on previous study efforts, and had developed and adopted, or were in the process of adopting, a range of mixed use, transit oriented development (TOD) plans for sites along the proposed alignments.

In summary, the following corridor cities have station-related development plans and/or TOD policies: Los Angeles, South Gate, Downey, Paramount, Bellflower, Cerritos, Artesia, Stanton, Garden Grove, and Santa Ana. The cities of Vernon, Huntington Park, and Buena Park identified that the proposed transportation improvements would support their land use and mobility plans, while the cities of La Palma and Cypress stated that any reuse of the PEROW/WSAB Corridor ROW would negatively impact their cities. Cypress Community College expressed interest in possibly accommodating a transit station on their campus, which is located along the PEROW/WSAB Corridor ROW.

Table 4.13 – Transit Supportive Land Use Policies

Proposed Station	City	TOD Plan	BRT Stations	Urban Rail Stations	High Speed Service Stations
Union Station	Los Angeles	Yes	✓	✓	✓
Soto/Olympic	Los Angeles	Yes	TBD	✓	
Leonis/District	Vernon	Yes	TBD	✓	
Gage/Florence	Huntington Park	TBD	TBD	✓	
Firestone Boulevard	South Gate	Yes	TBD	✓	
Gardendale Street	Downey	Yes	TBD	✓	
Metro Green Line	Paramount	TBD	✓	✓	✓
Paramount/Rosecrans	Paramount	Yes	✓	✓	
Bellflower Boulevard	Bellflower	Yes	✓	✓	
183 rd Street/Gridley Road	Cerritos	Yes	✓	✓	✓
Cypress College	Cypress	TBD	✓	✓	
Beach Boulevard	Stanton	Yes	✓	✓	✓
Brookhurst Street	Garden Grove	Yes	✓	✓	
Harbor Boulevard	Garden Grove	Yes	✓	✓	
Bristol Street	Santa Ana	Yes	✓	✓	
SARTC	Santa Ana	Yes	✓	✓	✓

Blank spaces indicate no proposed station under this alternative.

4.6 Project Feasibility

4.6.1 Implementation Viability

As presented in Table 4.14, a preliminary identification and assessment of the implementation feasibility of the proposed alternatives was completed based on the following four major factors:

1. **Metro/OCTA System Fit** – What transit service operators would construct, operate, and maintain each of the proposed alternatives? How would the proposed alternatives fit with existing transit systems, operational and adopted plans, and funding capabilities? Within the Corridor Study Area, Metro and OCTA are the primary transit service operators. Both agencies have adopted operational and long range transportation plans incorporating their service and funding plans through 2035. Currently, Metro operates BRT services, while OCTA is planning to provide BRT services in the future. Metro provides urban rail service through an extensive LRT system. For the alternatives:
 - Street Car service is being studied in Orange County through the Santa Ana-Garden Grove Fixed Guideway Project which includes a portion of the PEROW/WSAB Corridor, and there may be a future street car system operator that could be responsible for street car operations.
 - Diesel Multiple Unit Alternative – there is no existing operating entity; neither Metro nor OCTA are considering the modal option based on their long range transportation plans.
 - High Speed Conventional Steel Wheel Alternative – It is assumed that this service option would be operated by the California High Speed Rail Authority (CHSR), if implemented.

- High Speed Magnetic Levitation Alternative – there is no existing operating entity; a future operational entity may be identified.
2. **CAHST System Fit** – The fit of the two High Speed Service alternatives with the statewide high speed system being planned, design, and built by the CHSR was considered. It would be ideal if there was a system fit allowing the corridor project to leverage additional regional access and funding. If there was a fit, corridor service could be interlined with the statewide system. In addition, the PEROW/WSAB Corridor ROW project then could utilize system elements being constructed and funded under the state program, including operational control (dispatch) systems and maintenance and storage facilities, as well as vehicle procurement plans. As initially designed, the Conventional Steel Wheel Alternative would possibly fit with the planned CAHST system, but the Magnetic Levitation Alternative would not due to different system and vehicle requirements.
 3. **Domestic Revenue Service** – Under this criterion, the operational feasibility of the proposed alternatives was evaluated based on whether it represented a technology utilized by an existing operational system, or in design/under construction in the U.S.. This factor not only represents a domestic knowledge and familiarity with the service type from a design and construction perspective, but also reflects agency approval, such as the Federal Railroad Administration (FRA) and the California Public Utilities Commission (CPUC). The introduction of a new modal alternative requires local transportation agency time and financial commitments to secure agency approval. For example, when NCTD sought to implement the first DMU service in California on an infrequently utilized freight rail ROW, they went through a lengthy and arduous approval process with the FRA and CPUC, with approval requiring more than two years, and related staff and consultant expenditures. Any transit option that is already approved by the CPUC and the FRA would save time and money towards implementing actual service. Of the Initial Set of Alternatives, the BRT, Street Car, LRT, Conventional Steel Wheel, and now the DMU option, are in domestic service. It should be noted that Street Car service, being considered in Santa Ana/Garden Grove are going through the CPUC approval process. While in operations throughout the rest of world, the Magnetic Levitation Alternative is not currently in operation or under construction within the U.S. at this time and would be required to go through the state and federal approval process.

Table 4.14 – Assessment of Implementation Viability

Criteria	BRT	Street Car	LRT	DMU	High Speed Service	
					Conventional	Maglev
System Fit	Metro, OCTA	Possible OCTA	Metro	No existing Entity	Possible CHST	Not yet
Domestic Revenue Service	Yes	Yes	Yes	Yes	Yes	Not yet
Can Meet Federal “Buy American” Requirements	Yes	Yes	Yes	Not yet	Yes	Not yet

4. **Meet Federal “Buy America” requirements** – In addition to many regional agencies’ desire to buy project-related components locally to support economic development and employment opportunities, there are also related federal requirements. Under federal regulations (49CFR661.1, revised October 1, 2009), all federally assisted projects require that the following elements be produced in the U.S. under the “Buy America” requirements:

- Rolling stock (vehicles) including train control, communication, and power equipment;
- Steel and iron products such as structures, bridges, and track work; and
- Manufactured end products including structures, ties and ballast, and fare collection, information, and security systems,

A majority of the transit vehicles operating in the U.S. have faced the issue of purchasing vehicles made in this country, including BRT, Street Car, LRT, and DMU vehicles; only conventional steel wheel HSR locomotives and passenger cars are made in the U.S. With the evolving and growing transit market, there are more American-made vehicles available to select from. Maglev, as an emerging technology, will have to address this issue.

4.6.2 Project Feasibility

During Initial Screening, project feasibility was based on an identification and assessment of engineering constraints and challenges through field visits, research, and conceptual-level engineering at key locations:

- **Constrained Right-of-Way Width** – Site visits were made to assess the height and width of the PEROW/WSAB Corridor ROW where it crossed under the SR-91 and I-605 freeways, as well as the I-105 and I-710 freeways where the use of the Ports-owned San Pedro Subdivision is proposed. An initial assessment identified that there appeared to be sufficient room for at-grade operations, but that above-grade operations may not be possible in some of the freeway undercrossings. In addition, there may not be sufficient space for the provision of integrated pedestrian and bicycle facilities and alternative routing would need to be identified. While all four freeway undercrossings will be studied further in the next phase, utilization of the San Pedro Subdivision ROW under the I-105 Freeway will require particular analysis to assess the engineering impacts and costs.
- **Encroachments on the PEROW/WSAB Corridor ROW** – A visual assessment and field visits confirmed that there have been public and private encroachments onto the former railroad ROW. The encroachments are more minor in Los Angeles County with several commercial uses allowed to use part of the ROW, and there is a pedestrian bridge over the ROW connecting portions of Paramount High School located on opposite sides of the ROW. In Orange County, the major encroachments have been approved by OCTA: a portion was sold to the City of Garden Grove for a commercial development and related parking, with aerial rights reserved, and the City of Buena Park has two small parks on the ROW; and OCTA uses a portion of the ROW for bus storage purposes. In the City of Santa Ana, residential, commercial and industrial properties have been built on the ROW over the years.
- **Utility Issues** – An assessment of the utility issues identified a significant number of underground utilities typically running perpendicular to the ROW, and overhead utilities crossing or running along the ROW that will need to be considered in future engineering plans. An oil line runs along the Metro-owned portion of the ROW to provide service to the Paramount Petroleum Facility.

- **Flood Channel Issues** – Within Los Angeles County, the proposed alignment crosses the Los Angeles River twice, the San Gabriel River, and the Coyote Creek Flood Control Channel at the county line. In addition, a portion of the ROW is used for a flood channel in the southern portion of Los Angeles County. In Orange County, the proposed ROW crosses the Santa Ana River. All of the facilities are under the jurisdiction of the U.S. Army Corps of Engineers.

Northern Connection Issues

There are two options for the connection north from the PEROW/WSAB Corridor ROW terminus in the city of Paramount to Downtown Los Angeles:

1. **East Alignment Alternative** – Under this option, the Urban Rail and High Speed Service alternatives would connect from the northern terminus of the PEROW/WSAB Corridor ROW to the San Pedro subdivision ROW, now owned by the Ports of Long Beach and Los Angeles. Urban rail travel would share the ROW and the High Speed Service options would operate above the ROW. Both sets of alternatives would then travel north to where the ports-owned ROW intersects with a UP-owned ROW utilized by freight and Metrolink passenger rail service where they would share the UP ROW for a short distance to where the ROW, now owned by Metro and operated by Metrolink, turns north to travel along the east bank of the Los Angeles River and then cross over the river into Union Station.
2. **West Alignment Alternative** – This alternative alignment also would connect from the northern terminus of the PEROW/WSAB Corridor ROW to the San Pedro Subdivision, but is proposed to be used only by the Urban Rail Alternatives. The proposed alignment would then turn west to travel along one of several existing and former railroad ROWs, such as those located in the median of Independence Avenue or Randolph Street, to the vicinity of Alameda Street. At this point, the alignment would travel north possibly along Alameda Street or another street to connect north through Downtown Los Angeles. There are several alignment options in this area that have been proposed and will be clarified and evaluated in the next study phase.

As discussed below by alternative, many of the opportunities and constraints in the Northern Connections area are similar for all of the alternatives, with the exception of the BRT Alternative:

A. Constrained Freeway Undercrossings

- This is just one example of the challenges facing all of the alternatives in interfacing with the study area's existing infrastructure. The PEROW/WSAB Corridor ROW and the proposed Northern Connection alignments will cross under four freeways: the I-605, SR-91, I-105, and I-710. In all cases, there are existing underpasses that need to be evaluated to identify if the width and the height of the undercrossings is sufficient to accommodate the proposed alternatives. An initial assessment identified that there appears to be sufficient room for at-grade operations, but that above-grade operations may not be possible at some locations.

B. At-Grade versus Above-Grade Operations

- Whether alternatives operate in an at-grade or above-grade configuration, they may have benefits and impacts, including travel speed and time benefits, as well as cost, traffic circulation, noise and vibration, visual and privacy, and safety impacts. During the final screening phase, a preliminary definition of the appropriate combination of vertical system operations will be identified based on: technical and environmental analysis, Metro's adopted Grade Separation Policy as appropriate, and close coordination with the affected cities.

C. Assess City Traffic Impacts

- Whether the proposed transit system operates at- or above-grade, introduction of a high-capacity transportation system improvement will have impacts on the city street operations. At-grade systems may result in impacts including traffic capacity and flow impacts and removal of on-street parking, while above-grade systems, primarily due to column placement, may include street capacity impacts and removal of left-turn lanes and on-street parking. A conceptual level of analysis will be performed during the next study phase, and detailed plans will be developed as the project moves forward in the preliminary engineering and environmental analysis phase.

D. Assess Freight Rail Operational Impacts

- Both the Urban Rail and High Speed Service alternatives are proposed to connect north to Downtown Los Angeles through the use of several railroad ROWs: the San Pedro Subdivision owned by the Ports of Long Beach and Los Angeles, with some freight rail customers; the UP-owned ROW used by UP with freight and Metrolink passenger operations; and tracks along the east bank of the Los Angeles River owned by Metro and with passenger service operated by Metrolink and freight service by UP. Whether the proposed transit system operates at- or above-grade, introduction of a high-capacity transportation system improvement will have impacts on rail operations. Introduction of new passenger rail service will require the cooperation of the impacted ROW owners/operators, and the approval of governmental agencies including the FRA and CPUC.

E. Optimal Station Spacing

- Final station spacing will be based on a wide range of factors including desired travel speed, support for local economic development and revitalization plans, and project costs.

BRT Alternatives – Opportunities and Constraints

As shown in Figure 4.1, implementation of the street- and freeway-running BRT Alternatives would have the following opportunities and constraints in the Northern Connections area north from the terminus of the PEROW/WSAB Corridor ROW in the City of Paramount:

A. Downtown Los Angeles service routing

- For both BRT alignment alternatives, efforts in the next study phase will identify the optimal service routing through Downtown Los Angeles to connect Corridor Study Area passengers with their desired destinations, and provide the easiest interface with other bus and rail service options in order to minimize transfers.

B. I-110 Transitway capacity

- The freeway-running BRT Alternative will operate along the I-110 Transitway from Downtown Los Angeles south to the I-105 Freeway. An assessment of the I-110 Transitway operational capacity to confirm that sufficient space exists to accommodate the proposed PEROW/WSAB Corridor ROW BRT service will be performed in the next study phase.

C. Interface with Metro Green Line

- Both BRT alignment alternatives will provide a transfer connection to the Metro Green Line Lakewood Boulevard Station. The desirability of the freeway-running alternative of serving the three other Green Line stations, particularly the Imperial/Wilmington Station (which would allow for a transfer to the Metro Blue Line), along with the Long Beach Boulevard Station in the

City of Lynwood and the Avalon Station in the Willowbrook section of the City of Los Angeles will need to be assessed. In the next phase, efforts will include an assessment of the ease of access to/from the I-105 Freeway HOV lanes to serve each of the stations, and the resulting impacts on travel times and ridership.

D. Access to/from I-105 HOV Lanes at Metro Green Line Lakewood Boulevard Station

- ▶ The freeway-running alternative will leave the PEROW/WSAB Corridor ROW in the City of Paramount and travel north on Lakewood Boulevard to provide a transfer to the Metro Green Lakewood Boulevard Station. It would then access the I-105 Freeway from the Lakewood Boulevard on-ramp and travel to the first entry point into the westbound HOV lane. An assessment of the ease of access from the Lakewood Boulevard on-ramp to the I-105 Freeway HOV lane needs to be undertaken and impacts on travel time identified.

E. Operate with signal priority system

- ▶ Provision of signal priority will improve street-running BRT travel speeds and reduce travel times. A majority of the preliminary alignment was proposed to operate on Soto Street and Long Beach Boulevard. Within the City of Los Angeles, there is a bus signal priority system in place along this alignment. In the next phase, study efforts will confirm that the portion of the alignment outside the City of Los Angeles has plans for extension of the signal priority system is in planned and funded, and if not develop implementation plans.

F. Fit with Metro Rapid Service

- ▶ Street-running BRT service will interface with, and be fed by, the Metro Rapid network in this portion of the Corridor Study Area. As operational plans are developed in the next phase, BRT stations and schedules will be identified to support ease of passenger access between the local and regional bus services.

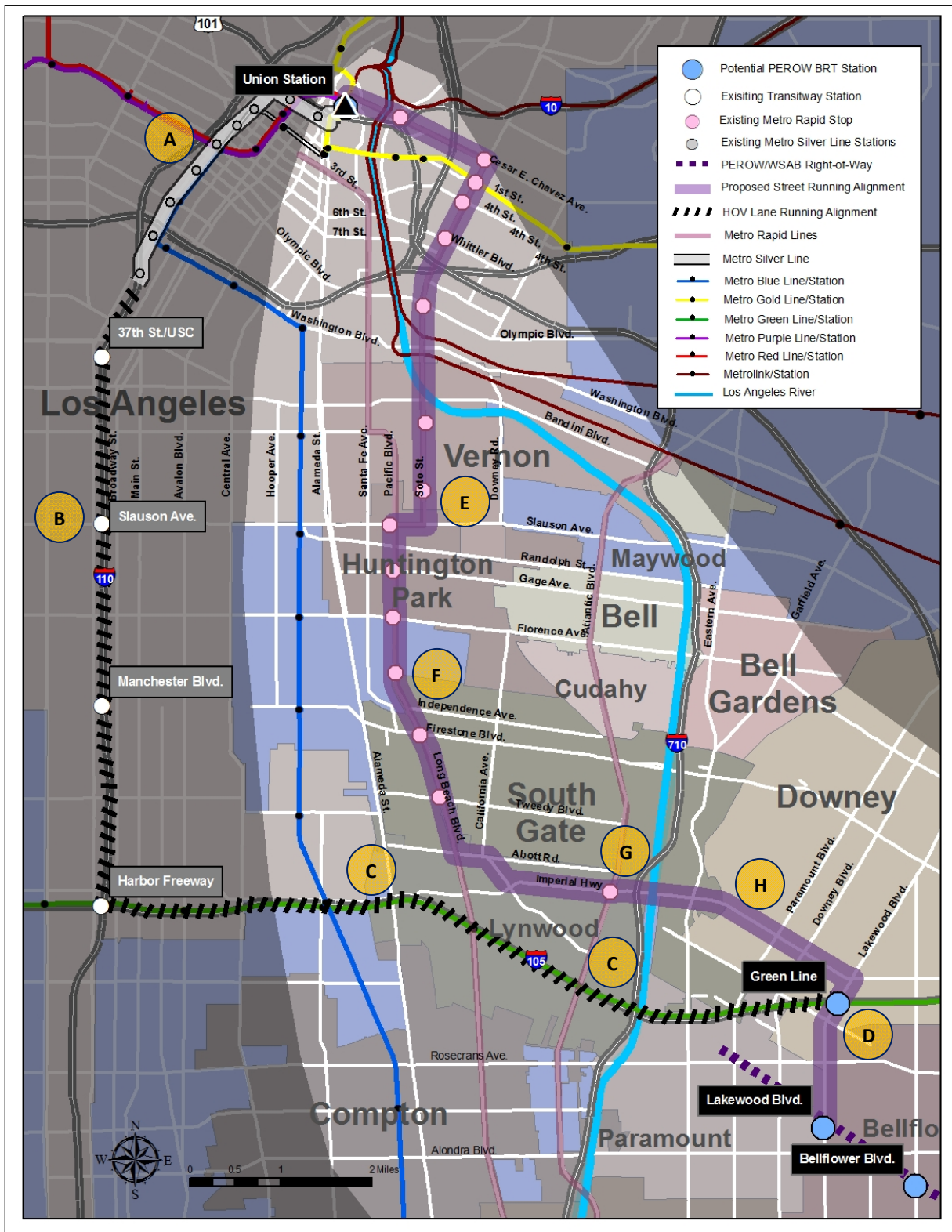
G. Identify Optimal East-West Street for BRT Operations

- ▶ The proposed north-south alignment identified during Initial Screening for the street-running BRT alternative turns to operate on Imperial Highway to provide a connection to the Metro Green Line Lakewood Boulevard Station just north of the terminus of the PEROW/WSAB Corridor ROW in the City of Paramount. In the next phase, other east-west streets that may be more viable for making that east-west connection, such as Florence Avenue or Firestone Boulevard, will be identified and evaluated working closely with Metro Operations staff.

H. Implement BRT Signal Priority System

- ▶ Currently there are no bus service signal priority systems in place in this section of the Corridor Study Area. Signalization decisions are under the jurisdiction of Los Angeles County to ensure coordination among the jurisdictions along these major arterials. Once the optimal east-west street is identified for the street-running alternative, plans to implement signal priority will be developed working closely with Los Angeles County staff.

Figure 4.1 – BRT Alternatives: Opportunities and Constraints



Urban Rail Alternatives – Opportunities and Constraints

As shown in Figure 4.2, implementation of the Urban Rail Alternatives would have the following opportunities and constraints in the Northern Connections area north from the terminus of the PEROW/WSAB Corridor ROW in the City of Paramount:

A. New Metro Green Line Station

- Cost and Service Interruptions – A new station would be required to provide a connection to the Metro Green Line from the San Pedro Subdivision. The cost to build and the operational impacts during construction of a new station will be identified and assessed.
- Fit with freeway median and operational impacts – With the Metro Green Line operating in the median of the I-105 Freeway, the possibility of expanding the median to accommodate a new station, along with the resulting impacts on the freeway operations at this complicated system point where the I-105 Freeway interfaces with the I-710 Freeway needs to be clarified with Caltrans and preliminary engineering assessment.
- Accommodate both new rail and freight service – The San Pedro Subdivision passes over the I-105 Freeway and the Metro Green Line. The current railroad bridge over the freeway is single-track, and must be rebuilt to provide sufficient width to accommodate existing freight service, new urban rail service, and platforms and circulation elements to allow access down to the proposed Metro Green Line station.

B. San Pedro Subdivision owned by Ports of Long Beach and Los Angeles

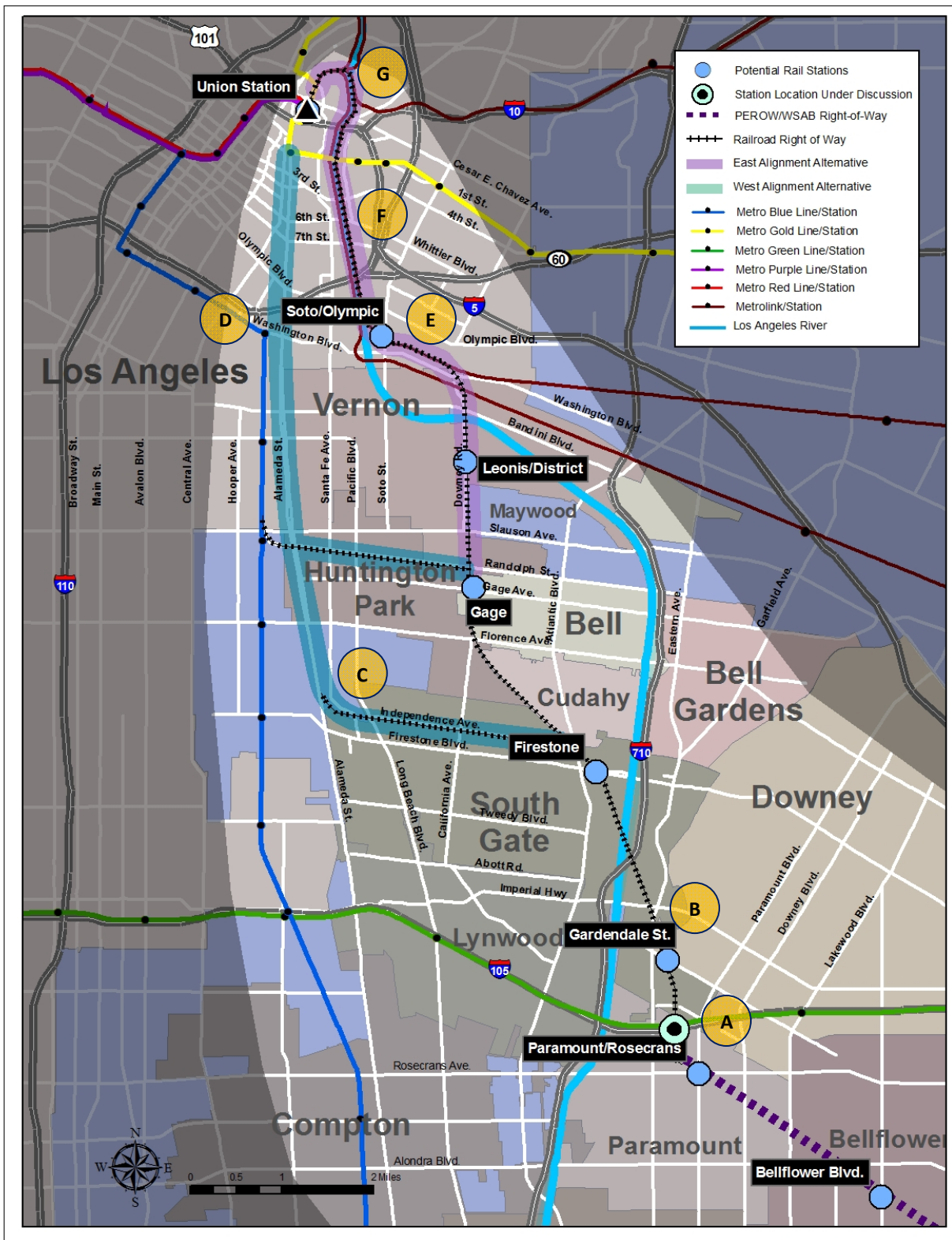
- The Ports have expressed initial interest in selling the ROW for the project, but UP has the first right to purchase the ROW, and this alignment is part of the Alameda Corridor agreement to provide emergency freight service from the ports.
- Freight rail compatibility issues – While the San Pedro ROW currently provides service to only a few customers, any use of the ROW must be designed to accommodate freight rail operations and maintenance along with any new urban rail passenger use. The ROW has a constrained width as well as several older, single-track bridges, and a more detailed survey and engineering assessment will be performed in the next phase.
- CPUC approval required – Any operational change to the San Pedro ROW, especially the introduction of passenger rail service, will require close coordination with and the approval of the CPUC.

The Urban Rail Alignment would continue north on the Ports-owned San Pedro Subdivision ROW or turn west to:

C. Operate on inactive or active railroad lines

- Reuse of railroad ROWs located in the median of streets, such as Independence Avenue and Randolph Street, will require the support of the Cities of South Gate, Cudahy, Huntington Park, Vernon, and Los Angeles in which they are located.
- There are ROW width constraints in some locations where freight rail service is still provided and the location and space for possible stations needs to be assessed.
- Operating through highly-developed and densely-populated communities will require careful engineering to address related vehicular and pedestrian safety issues.

Figure 4.2 – Urban Rail Alternatives: Opportunities and Constraints



D. Operate on/under/above streets in the city of Los Angeles

- The major proposed access into Downtown Los Angeles is along Alameda Street, or another street to be identified in the next study phase, which serves as the main access point for a majority of the heavy truck activity serving the city's industrial destinations. Adding urban rail operations into this highly-traveled corridor will be challenging.
- Community fit – While a majority of the land uses are industrial in the southern portion of eastern Downtown, a residential community exists along with future plans for a Clean Tech corridor. Introduction of an urban rail alternative would provide improved access to these key existing and planned destinations, but must be designed to fit within the existing and planned community context.

Continuing north on the Ports-owned ROW, the Urban Rail Alternatives would:

E. Interface with the BNSF and UP Railroads and the future CAHST system

- North of the Bandini Boulevard area, the San Pedro Subdivision crosses a BNSF-owned crossing and one of the proposed alignments for the California High Speed Train system. Coordination with and approval of the BNSF, and interface with the CAHST system will be required.
- The Urban Rail alignment would then operate on or above an UP-owned ROW that accommodates both freight and Metrolink passenger rail service. The trackage in this segment is highly utilized and nearing capacity, so adding new service in this area will be challenging. Sharing the freight tracks or ROW will require a FRA-approved freight compatible vehicle or operation in an above-grade configuration that would accommodate freight trains and bi-level Metrolink trains; and will require approval by UP, as well as the California Public Utilities Commission (CPUC). These are very challenging constraints.

F. Operate on Metro-owned tracks with UP freight and passenger rail service

- As the ROW turns to run north along the eastern bank of Los Angeles River, the trackage is owned by Metro and operated by Metrolink. This heavily-utilized trackage provides access for Metrolink passenger rail service into Union Station, and freight rail activity into UP's Intermodal Yards located here.

G. Access into Union Station

- The existing railroad bridge crossing the Los Angeles River, while sufficient to handle current rail activity, appears as if it would require retrofitting or replacement to accommodate increased usage by urban rail passenger service. Revisions to the bridge would require coordination with a number of entities, including the U.S. Army Corps of Engineers.
- With the high level of Amtrak and Metrolink passenger activity, Union Station trackage is at-capacity. It also is planned to serve as a major hub of the future CAHST system pushing Union Station beyond capacity and requiring analysis of a proposed second level.

High Speed Service Alternatives – Opportunities and Constraints

As shown in Figure 4.3, implementation of the High Speed Service Alternatives would have similar opportunities and constraints as the Urban Rail alternatives in the Northern Connections area north from the terminus of the PEROW/WSAB Corridor ROW in the City of Paramount:

A. New Metro Green Line Station

- Cost and Service Interruptions – A new station would be required to provide a connection to

the Metro Green Line from the San Pedro Subdivision. The cost to build and the operational impacts during construction of a new station will be identified and assessed.

- Fit with freeway median and operational impacts – With the Metro Green Line operating in the median of the I-105 Freeway, the possibility of expanding the median to accommodate a new station, along with the resulting impacts on the freeway operations at this complicated system point where the I-105 Freeway interfaces with the I-710 Freeway needs to be clarified with Caltrans and preliminary engineering assessment.
- Accommodate both new rail and freight service – The San Pedro Subdivision passes over the I-105 Freeway and the Metro Green Line. The current railroad bridge over the freeway is single-track, and must be rebuilt to provide sufficient width to accommodate existing freight service, new high speed service, and platforms and circulation elements to allow access down to the proposed Metro Green Line station.

B. San Pedro Subdivision owned by Ports of Long Beach and Los Angeles

- The Ports have expressed initial interest in selling the ROW for the project, but UP has the first right to purchase the ROW, and this alignment is part of the Alameda Corridor agreement to provide emergency freight service from the ports.
- Freight rail compatibility issues – While the San Pedro ROW currently provides service to only a few customers, any use of the ROW must be designed to accommodate freight rail operations and maintenance along with any new aerial high speed service passenger use. The ROW has a constrained width as well as several older, single-track bridges, and a more detailed survey and engineering assessment will be performed in the next phase.
- CPUC approval required – Any operational change to the San Pedro ROW, especially the introduction of passenger rail service, will require close coordination with and the approval of the CPUC.

Continuing north on the Ports-owned ROW, the High Speed Service alternatives would:

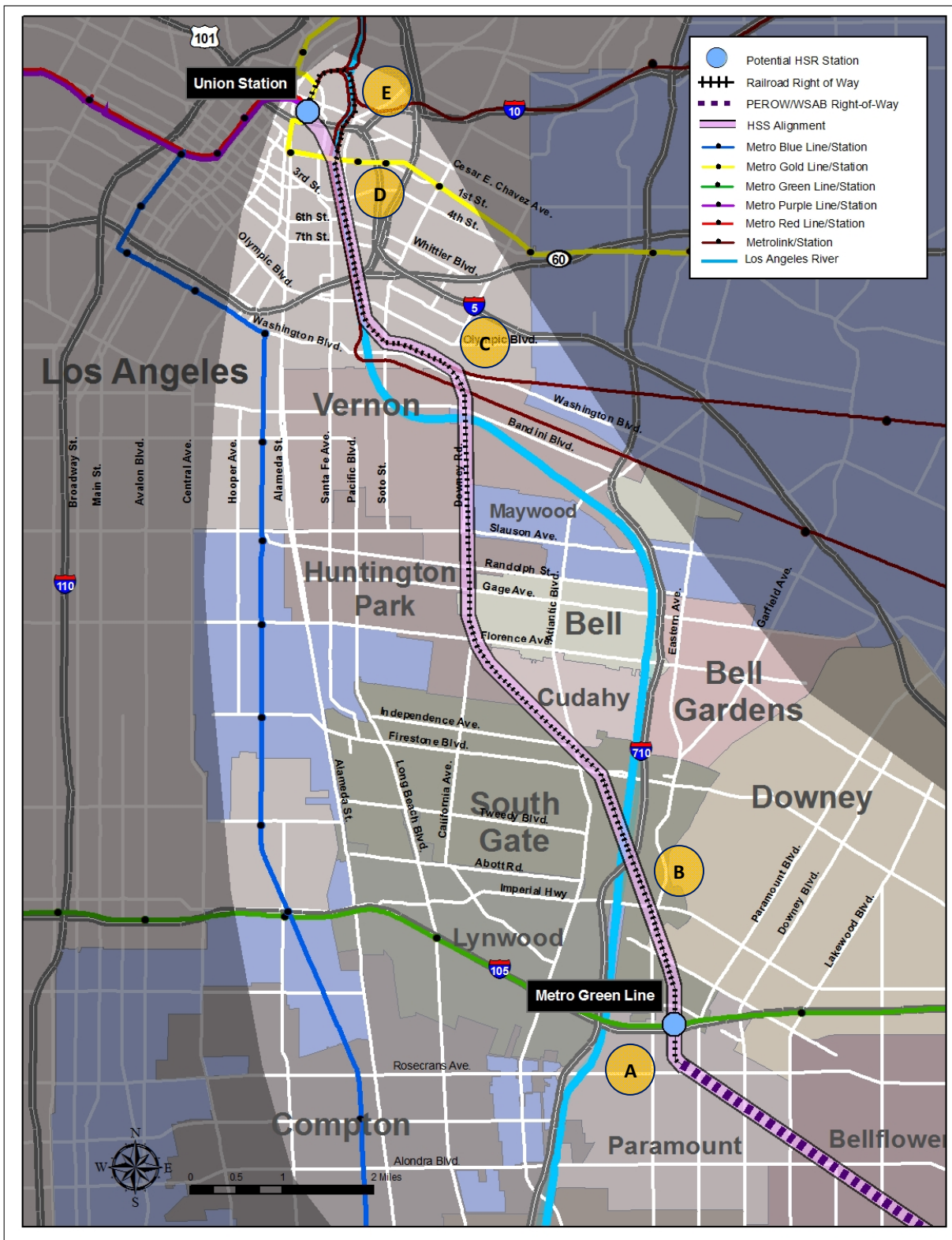
C. Interface with the BNSF and UP Railroads and the future CAHST system

- North of the Bandini Boulevard area, the San Pedro Subdivision crosses a BNSF-owned crossing and one of the proposed alignments for the California High Speed Train system. Coordination with and approval of the BNSF, and interface with the CAHST system will be required.
- The High Speed Service alignment would then operate on or above an UP-owned ROW that accommodates both freight and Metrolink passenger rail service. The trackage in this segment is highly utilized and nearing capacity, so adding new service in this area will be challenging. Sharing the freight tracks or ROW will require a FRA-approved freight compatible vehicle or operation in an above-grade configuration that would accommodate freight trains and bi-level Metrolink trains; and will require approval by UP, as well as the California Public Utilities Commission (CPUC). These are very challenging constraints.

D. Operate on Metro-owned tracks with UP freight and passenger rail service

- As the ROW turns to run north along the eastern bank of Los Angeles River, the trackage is owned by Metro and operated by Metrolink. This heavily-utilized trackage provides access for Metrolink passenger rail service into Union Station, and freight rail activity into UP's Intermodal Yards located here.

Figure 4.3 – High Speed Rail Alternatives: Opportunities and Constraints



E. Access into Union Station

- The existing railroad bridge crossing the Los Angeles River, while sufficient to handle current rail activity, appears as if it would require retrofitting or replacement to accommodate increased usage by urban rail passenger service. Revisions to the bridge would require coordination with a number of entities, including the U.S. Army Corps of Engineers.
- With the high level of Amtrak and Metrolink passenger activity, Union Station trackage is at-capacity. It also is planned to serve as a major hub of the future CAHST system pushing Union Station beyond capacity and requiring analysis of a proposed second level.

Southern Connection Issues

As illustrated in Figure 4.4, implementation of the alternatives face similar opportunities and constraints in the Southern Connections area:

A. Constrained Freeway Undercrossings

- This is just one example of the challenges facing all of the alternatives in interfacing with the study area's existing infrastructure. The PEROW/WSAB Corridor ROW and the proposed Southern Connection alignments will cross two freeways: the I-605 and SR-22. In both cases, there are existing freeway underpasses that need to be evaluated to identify if the width and the height of the undercrossings is sufficient to accommodate the proposed alternatives. An initial assessment identified that there appears to be sufficient room for at-grade operations, but that above-grade operations may not be possible in some of the freeway undercrossings.

B. At-Grade versus Above-Grade Operations

- Whether alternatives operate in an at-grade or above-grade configuration they have many benefits and impacts, including travel speed and time benefits, as well as cost, traffic circulation, noise and vibration, visual and privacy, and safety impacts. During the next study phase, a preliminary definition of the appropriate combination of vertical system operations will be identified based on: technical and environmental analysis, Metro's adopted Grade Separation Policy as appropriate and close coordination with the affected cities.

C. Assess City Traffic Impacts

- Whether the proposed transit system operates at- or above-grade, introduction of a high-capacity transportation system improvement will have impacts on city street operations. At-grade systems may result in impacts to traffic capacity and flow, and the removal of on-street parking. Column placement issues related to an above-grade system may include street capacity impacts and removal of left-turn lanes and on-street parking. A conceptual level of analysis will be performed during the next study phase, and detailed plans will be developed as the project moves forward in the preliminary engineering and environmental analysis phase.

D. Optimal Station Spacing

- Final station spacing will be based on a wide range of factors including desired travel speed, support for local economic development and revitalization plans, and project costs.

E. Interface with Santa Ana-Garden Grove Fixed Guideway Project

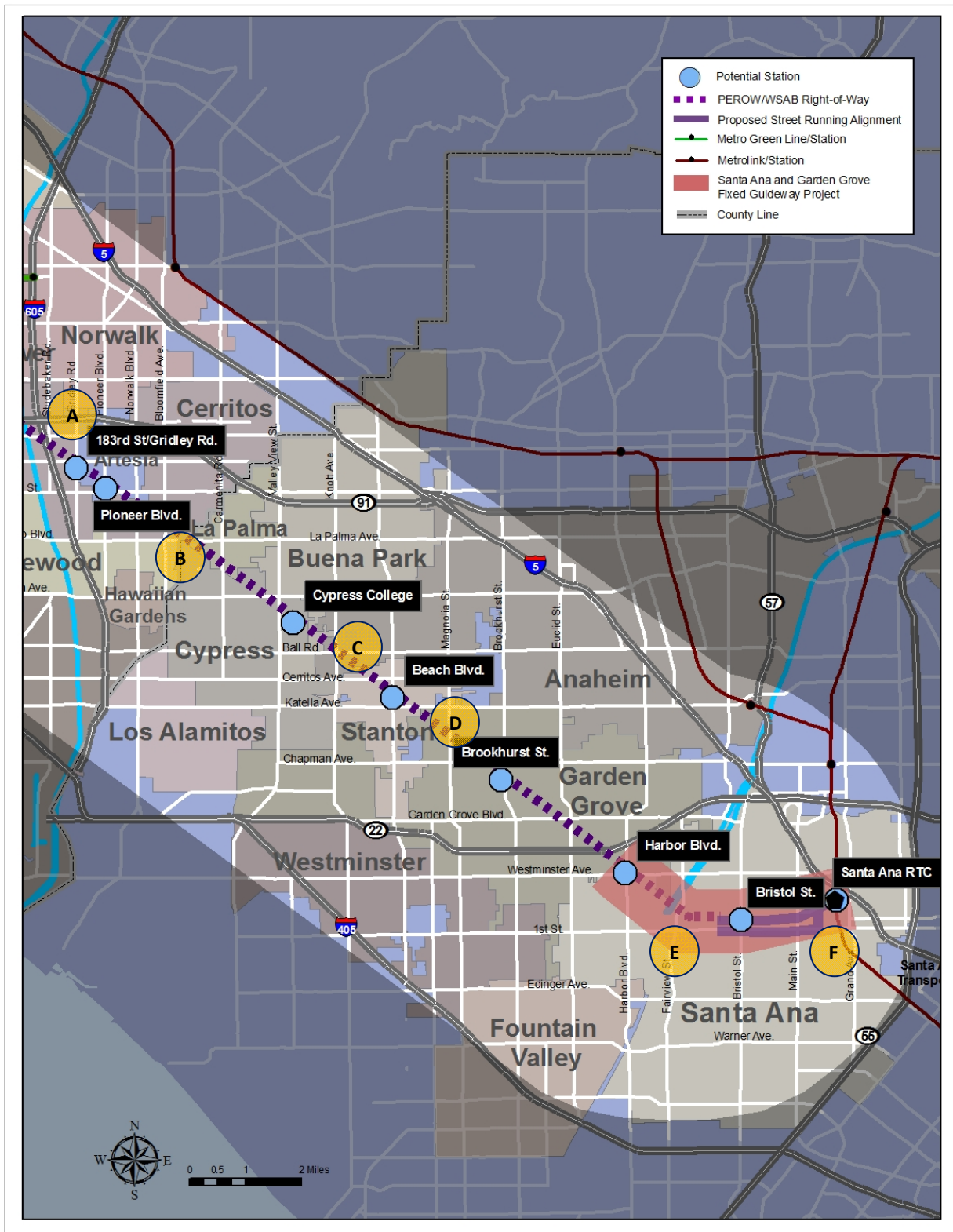
- Currently, the cities of Santa Ana and Garden Grove are studying reuse of a portion of the PEROW/WSAB Corridor ROW, along with connections through the City of Santa Ana from where the ROW ends at Raitt Street, to provide Street Car service. The Fixed Guideway study

is scheduled for completion in 2011, with preparation of a draft environmental document by the Summer of 2012. Construction of the first phase to Bristol Street is projected to start in late 2015. How the alternative identified in the PEROW/WSAB Corridor AA interfaces with this study's final alignment recommendation and implementation timeframe has been initially assessed during the AA study and will be evaluated further in the next phase.

F. Circulation through City of Santa Ana

- At-grade BRT or Urban Rail operations will provision of a signal priority system to minimize impacts from the terminus of the PEROW/WSAB ROW through the City of Santa Ana to the SARTC to minimize traffic impacts and maximize transit operations.

Figure 4.4 – Southern Connection: Opportunities and Constraints



4.7 Environmental Impacts and Benefits

Implementation of any transportation may result in environmental and community impacts. During the initial screening effort, an initial impact assessment was prepared for the following key issues, which were identified as key concerns by corridor stakeholders and the community:

- Noise and Vibration;
- Air Quality;
- Visual and Privacy;
- Traffic Impacts; and
- Property acquisition

4.7.1 Noise and Vibration

Noise is defined as unwanted sound. Several factors affect the actual level and quality of sound (or noise) as perceived by the human ear: loudness, pitch (or frequency), and time variation. The loudness or magnitude, of noise determines its intensity, which is measured in decibels (dB) that can range from below 40 dB (the rustling of leaves) to over 100 dB (a rock concert). Pitch describes the character and frequency content of noise, such as the low “rumbling” noise of a stereo woofer or the high-pitched noise of a piercing whistle. Finally, the time variation of noise sources can be characterized as: continuous, such as a building ventilation fan; intermittent, such as the passing of trains; or impulsive, such as pile-driving activities during construction. Various sound levels are used to quantify noise from transit sources, including a sound’s loudness, tonal character, and duration. For example, the A-weighted decibel (dBA) is commonly used to describe the overall noise level, because it more closely matches the human ear’s response to audible frequencies. Because the A-weighted decibel scale is logarithmic, a 10 dBA increase in a noise level is generally perceived as a doubling of loudness, while a three dBA increase in noise level is barely perceptible to the human ear.

When evaluating the noise impacts resulting from implementation of a transportation system, the first step is to identify the existing background noise level, which can vary from 50 dBA in a quiet residential area to more than 70 dBA in an urban setting. The noise level created by operation of the proposed alternatives then is evaluated against the background noise to identify impacts and mitigation measures to reduce any impacts. This level of analysis is typically performed during the preparation of preliminary engineering and draft environmental documents.

Table 4.15 – Conceptual Average 24-Hour Noise Exposure (dBA)

Highway (4 lanes)	BRT	Streetcar	LRT	DMU	High Speed Service	
					Conventional	Maglev
79	63/65	64	64	65	71	64

Source: FTA, *Transit Noise and Vibration Impact Assessment*.

At this point in the study process, possible noise impacts were identified based on FTA’s *Transit Noise and Vibration Impact Assessment* guidelines. As shown above in Table 4.13, all of the proposed transportation alternatives would result in a lower noise impact than a four lane highway. The two options with the highest possible impacts are: the DMU Alternative, due to the noise from its diesel engines; and the High Speed Steel Wheel Alternative which, though electrically-powered, typically has a

high level of noise due to the locomotive and vehicle weight. An electrically-powered BRT Alternative would result in the lowest noise impact, while diesel operations would be similar to the DMU Option.

Ground-borne vibration associated with vehicle movements is usually the result of uneven interactions between wheels and road or rail surfaces. Examples of such interactions (and subsequent vibrations) include train wheels running over a jointed rail (separate pieces of rail joined end-to-end with bolted plates to make one continuous surface upon which trains can operate), an untrue rail car wheel with “flats,” and a bus wheel hitting a pothole. Unlike noise, which travels in air, vibration from transit sources typically travels along the surface of the ground. Depending on the geological properties of the surrounding terrain and the type of building structures exposed to transit vibration, vibration propagation can be more or less efficient. Buildings with an on-grade slab are “coupled” more efficiently to the surrounding ground and experience relatively higher vibration than building located in sandy soil. In addition, masonry buildings are less susceptible to ground-borne vibration than wood-frame buildings because they absorb more of the vibration. Vibration caused by passing transit vehicles is discussed in terms of displacement (change of position), velocity (rate of change of position), or acceleration (change in velocity over time). However, human responses are more accurately described in terms of velocity.

A detailed vibration analysis is typically performed based on preliminary engineering documents during the preparation of draft environmental documents. At this point in the study process, possible vibration impacts were identified based on the vibration categories identified in FTA’s *Transit Noise and Vibration Impact Assessment* guidelines. It should be noted that FTA identifies any category 3 or higher vibration impacts as requiring mitigation. As shown below in Table 4.14, all of the proposed transportation alternatives would result in some vibration impact except for the rubber-tired BRT Option, and the slow speed Street Car Alternative. All of the other transportation alternatives would require some type of mitigation. Maglev falls in a higher category due to higher speeds and the resulting air replacement can cause significant vibration impacts. Mitigation measures can be as simple as placing at-grade rail guideway on ballast (gravel) with sound-deadening fasteners, and ensuring the design of aerial structural elements absorbs a majority of any vibration impacts, rather than transmit the vibration to the ground.

Table 4.16 – Conceptual Vibration Impacts by Vibration Category

Highway (4 lanes)	BRT	Street Car	LRT	DMU	High Speed Service	
					Conventional	Maglev
1	1	1/2	3	4/5	5	4/5

Source: FTA, *Transit Noise and Vibration Impact Assessment*.

4.7.2 Air Quality

As part of the Initial Screening efforts, an initial assessment of air quality impacts and benefits of proposed alternatives based on similar projects was prepared, and an initial consultation with South Coast Air Quality Management District (SCAQMD) staff was conducted. As shown in Table 4.15, implementation of all of the alternatives would result in local and regional air quality impacts over the No Build base conditions, with the exception of the DMU Alternative. While this option would provide benefits over No Build conditions for greenhouse gases, its clean diesel operations would result in a

minor increase in regional emissions from clean diesel operations, and would negatively impact local emissions, carbon monoxide, and toxics in the Corridor Study Area.

Table 4.17 – Air Quality Benefits and Impacts

	No Build	BRT	Street Car	LRT	DMU	High Speed Service	
						Conventional	Maglev
Regional Emissions	Base	Yes	Yes ¹	Yes ¹	Yes/No	Yes ¹	Yes ¹
Local Emissions	Base	Yes ²	Yes	Yes	No	Yes	Yes
Carbon Monoxide	Base	Yes ²	Yes	Yes	No	Yes	Yes
Toxics	Base	Yes ²	Yes	Yes	No	Yes	Yes
Greenhouse Gases	Base	Yes	Yes	Yes	Yes	Yes	Yes

1. Assumes electrical power for identified alternatives meets the California Renewables Portfolio Standard (RPS);

2. Assumes that the proposed BRT vehicles run on natural gas or other alternative fuel, rather than diesel.

A preliminary consultation with SCAQMD staff confirmed these findings, and they requested that the DMU Option be removed from further consideration even if powered by clean diesel. They indicated that while Metrolink currently operates with clean diesel power, a new transportation system should start right with no air quality impacts that would have to be mitigated in the future. During group discussions on the Initial Screening results, community members expressed their strong opinion that this option should be removed for the same reason.

4.7.3 Visual and Privacy

Residential properties represent more than 50 percent of the land uses along the PEROW/WSAB Corridor ROW. Reuse of the PEROW/WSAB Corridor ROW, the San Pedro Subdivision among other railroad ROWs, and city streets to make the northern connection, as well as using city streets to make the southern connection, will have significant visual and privacy impacts on adjacent residential properties. Figure 4.16 illustrates the possible impacts along the PEROW/WSAB Corridor ROW by showing the corridor ROW and the scale of the adjacent two- or three-story buildings, with the proposed transportation system shown in an at-grade and aerial configuration.

The average width of the ROW is 100 feet, with approximately 30 feet required for an at-grade system and 12-15 feet for an above-grade alternative. The remainder of the ROW could be used for an integrated pedestrian and bicycle facility and space for landscaping and sound walls to mitigate visual and privacy impacts which would work on the at-grade alignment and to a lesser degree on the aerial alignment. Construction of an aerial alignment will impact the scale, visual, and privacy of adjacent neighborhoods.

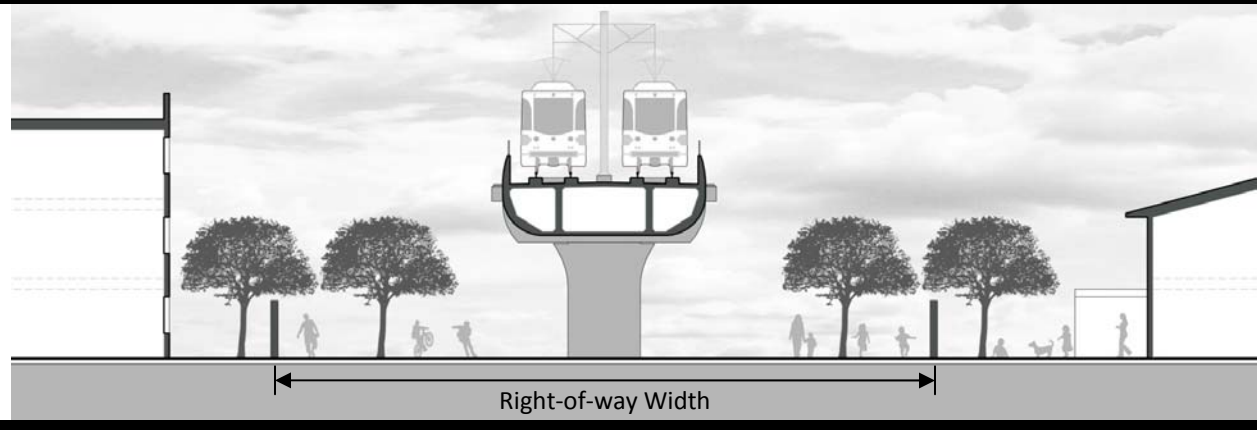
For an aerial alignment, it would be approximately 30 feet to top of the structure, 40 feet to the top of the vehicles, and mature 45 foot and higher trees could mitigate the visual and privacy impacts somewhat at key locations.

Table 4.18 – Visual and Privacy Impacts

At-grade



Above-grade



4.7.4 Traffic

Due to the unique diagonal street crossing of the PEROW/WSAB Corridor ROW and the proposed operation within or above city streets north and south from the corridor ROW, there will be traffic and parking impacts from implementation of any of the proposed transportation alternatives. At this study level, possible impacts have been identified that will be studied further during the preparation of conceptual level engineering documents. At-grade operational impacts may include the following:

- Lengthening of traffic signal cycles and resulting wait time;
- Street queuing and capacity impacts;
- Taking of on-street parking; and
- Vehicular, pedestrian, and bicycle safety impacts.

Above-grade system operational impacts, primarily due to column placement, may include the following:

- Street queuing and capacity impacts;
- Taking of left-turn lanes and on-street parking; and
- Visual impacts resulting in vehicular, pedestrian, and bicycle safety concerns.

4.7.5 Property Acquisition

When building a transportation system, property acquisition may be required for:

- Alignment and system requirements;
- Stations, bus and circulator transfer plazas and layover spaces, parking, and other facilities; and
- Station-area development and/or open space.

As presented below in Table 4.17, possible parcel acquisition was identified for the alternatives south from the Metro Green Line to the SARTC based on single-line engineering plans. In the next study phase, more detailed property needs will be identified based on clarification of the northern and southern connection routes, preparation of conceptual level engineering documents, and identification of proposed station elements. Based on current information, the possible acquisition of property primarily occurs where the alignments of the proposed alternatives transition at the northern terminus of the PEROW/WSAB Corridor ROW to travel north along the San Pedro Subdivision ROW, and at the southern end of the corridor ROW to travel through the City of Santa Ana to the SARTC. The BRT Alternative would not require any property acquisition as it is proposed to travel in either city streets or freeway HOV lanes after leaving the corridor ROW. The Street Car Option also would not require any acquisition as its tight turning radius could be accommodated within the PEROW/WSAB Corridor ROW, while the wider turning radius needs of the LRT and DMU alternatives would require acquisition of approximately 10 parcels. The 2,000-3,000 foot turning radius requirements of the High Speed Service options are estimated to require acquisitions of more than 125 parcels.

Table 4.19 – Possible Property Acquisition (Parcels)

BRT	Street Car	LRT	DMU	High Speed Service	
				Conventional	Maglev
--	--	10±	10±	125±	125±

4.8 Summary of Findings

A comparative analysis of the Initial Set of Alternatives has been completed to provide decision-makers and the public with an informed basis for selecting the most viable transportation strategies that would address the PEROW/WSAB Corridor Study Area's mobility needs, while being sensitive to community, environmental and economic development concerns. Table 4.20 on the following page presents a summary of Initial Screening results based on the key goals and criteria identified by the community:

- Serves local and regional trips
- Provides support for local economic development and revitalization plans
- Number of properties to be acquired
- Has air quality benefits
- Fits with current local system plans
- Has State and Federal approved vehicles
- Has strong conceptual ridership
- Conceptual cost to build
- Conceptual annual cost to build.

Table 4.20 – Initial Screening Results Summary

Criteria	BRT	Street Car	LRT	DMU	High Speed Service	
					Conventional	Maglev
Serves: Local trips Regional trips	✓ ✓	✓	✓ ✓	✓ ✓	✓	✓
Provides support for local plans	*	✓	✓	*	*	*
Requires property acquisition	Minimal	Minimal	Minor	Minor	Major	Major
Has air quality benefits	Yes	Yes	Yes	No**	Yes	Yes
Fit with local system plans	✓	✓	✓	No	No	No
Has State and Federal approved vehicles/system	✓ ✓	State in process ✓	✓ ✓	✓ ✓	✓ ✓	Not yet
Conceptual ridership	19,200-32,400	26,000-39,000	26,000-57,600	26,000-57,600	2,400-4,800	2,400-4,800
Conceptual cost to build (\$2010, billions)	\$0.6-2.2	\$1.3-4.0	\$1.6-4.2	\$1.2-4.1	\$4.9	\$5.9
Conceptual annual cost per rider	\$20-50	\$10-40	\$10-50	\$10-50	\$460-920	\$580-1,150

* Proven nationally and/or internationally

** Some regional benefits

4.9 Final Set of Alternatives

The Initial Set of Alternatives was assessed based on an initial evaluation of technical and environmental benefits and impacts. The comparative results were presented to elected officials, stakeholders, and the public. This second step in the three-step AA screening process, was intended to identify the Final Set of Alternatives that best met the Project's Purpose and Need, Mobility Problem, and Study Goals and Criteria for further study.

4.9.1 Development of Recommendations

The initial screening results were presented to and discussed through briefings held with elected officials and stakeholders from each Corridor Study Area city; public presentations to community and stakeholder groups; six community workshops conducted throughout the Corridor Study Area; study advisory committee briefings, including five Technical Advisory Committee (TAC) meetings, and three Steering Committee meetings. In April 2011, the following recommendations for the Final Set of Alternatives were developed by the TAC and approved by the Steering Committee:

1. Remove the following alternatives from further study:
 - Diesel Multiple Unit (DMU) Option; and
 - High Speed Service Alternatives, including both the Conventional Steel Wheel High Speed Rail and Magnetic Levitation High Speed Service options.
2. Add a Low Speed Magnetic Levitation Alternative to the study.

While the DMU Alternative had benefits, this option was viewed as having significant negative impacts that outweighed any positive aspects:

- **Public and Stakeholder Support** – Although some stakeholders saw the DMU Alternative as a potential transit solution for the corridor, this option did not receive widespread stakeholder and community support, primarily due to its use of diesel fuel for power.
- **Air Quality Concerns** – Stakeholders and community members cited air quality impacts and related public health concerns as their main reason for not supporting this alternative. They felt that the Corridor Study Area contained too many existing diesel sources, and that a new transit system should not introduce additional diesel impacts. Also, during a preliminary consultation with the South Coast Air Quality Management District, staff requested that the DMU Option be removed from further consideration. They identified their concerns that implementation of a DMU system would require future conversion to electrical power to meet evolving federal and regional emission requirements.
- **System Fit** – Introduction of this new transit technology was identified as incompatible with existing and future transit service plans – none of the Corridor Study Area transit providers currently operate or are considering DMU service. A new transit service entity would be required to operate the proposed DMU service, or current operators would have to significantly revise their long-term plans to provide new facilities, service standards, operating plans, and operating and maintenance staff.

The two High Speed Service (HSS) options were recommended for removal from further study based on a number of factors:

- **Public and Stakeholder Support** – A majority of public comments expressed the opinion that HSS service did not provide the appropriate transit service that was required in the corridor. HSS was viewed as exclusively serving regional transportation needs, rather than accommodating the combination of local and regional travel needs identified as part of the AA Goals and Criteria and Mobility Problem. Stakeholders expressed the concern that corridor communities would be negatively impacted by a HSS system operating through their communities without receiving commensurate benefits.
- **Trip Type Served** – The two HSS options were perceived as primarily serving longer-distance regional trips, which did not match the corridor’s more locally-based mobility needs. The Mobility Problem identified the need to primarily serve locally-based work and non-work trips, including residents and visitors traveling to and from employment, educational, shopping, recreational, cultural, and entertainment destinations.
- **System Fit** – Community members and stakeholders felt that corridor HSS service would be duplicative of the Los Angeles Union Station to Anaheim segment of the California High Speed Rail (CAHSR) system, which is being planned to operate approximately five miles to the north of the PEROW/WSAB Corridor ROW. While there was the potential for the Conventional Steel Wheel HSS Alternative to be operated as part of the CAHSR system, there was no existing service operator that provides or plans on providing Magnetic Levitation HSS service. Creation of a new service entity would be required, and the resulting service would be redundant to and incompatible with the planned CAHSR system.
- **Project Feasibility** – Many felt that the 34-mile long corridor was too short to support HSS travel – the federal HSS definition calls for connecting major population and employment centers that are 100 to 500 miles apart. Also, concern was expressed that the Magnetic Levitation Option represented an emerging technology that is unproven in the United States.
- **Station Spacing** – The HSS options’ wider station spacing did not support the corridor’s local economic revitalization and development goals and plans. These higher speed alternatives would provide only five stations in the Corridor Study Area, leaving 14 cities unserved by the future transit system improvement.
- **Acquisition Needs** – Public and community concern was expressed regarding the higher level of property acquisition requirements for the HSS options when compared with the other transit alternatives. The HSS options’ higher operating speeds require longer radius horizontal curves (2,000-3,000 feet compared to 350-400 feet for the Urban Rail Alternatives) at places where the proposed route changes direction. Initial analysis estimated the HSS alternatives would require the acquisition of approximately 125 properties to accommodate alignment transitions from the diagonal PEROW/WSAB Corridor ROW at the northern terminus in the City of Paramount to travel along the San Pedro Subdivision ROW into Downtown Los Angeles, and from the southern terminus of the corridor ROW in the City of Santa Ana to travel above city streets.
- **Cost-Effectiveness** – There were significant concerns about the high cost to build, operate, and ride the HSS service alternatives, especially when compared with the low ridership projections, making these options less cost-effective than the other alternatives.

- **Funding Availability** – Given that only Los Angeles County has identified funding for a future project in this corridor, and that the funding set aside is approximately \$270 million, public and stakeholder concerns were expressed about the funding availability to construct these more expensive alternatives. State-level public funding, with strong infusions of federal funding, have already been set aside for the CAHSR system. In other parts of the world, HSS projects have been able to produce higher operating revenues that can attract private sector interest in building and operating new HSS lines. These lines are typically three to nine times longer than the study corridor, and many community members believed that the corridor was not long enough to attract private sector interest, especially with the publicly-funded California system so close by.

While the Magnetic Levitation High Speed Service Alternative was recommended for deletion from further study, there was interest in evaluating the provision of lower speed magnetic levitation (maglev) service in the Corridor Study Area. Stakeholder interest was primarily based on maglev's perceived environmental benefits, including low operational noise and vibration impacts, and reduced air quality impacts due to the lack of rubber tire or steel wheel operations. Study of a Low Speed Maglev Alternative, similar to that operated as the Linimo Line in Nagoya, Japan, was proposed and included for further study. Although a low speed maglev alternative was not part of the Initial Set of Alternatives, and therefore no public input was received, a majority of the Steering Committee members felt that the low speed maglev alternative should be included and studied in the Final Set of Alternatives.

4.9.2 Recommended Final Set of Alternatives

In April 2011, the following six alternatives were approved by the Corridor Steering Committee for further study:

1. No Build
2. Transportation System Management
3. Bus Rapid Transit
4. Street Car
5. Light Rail Transit
6. Low Speed Magnetic Levitation.

The Final Set of Alternatives will be studied and evaluated based on conceptual-level technical information, including engineering and operating design, station location and prototypical design, capital and operating cost estimates, ridership forecast modeling information, land use and economic development support assessment, environmental impact analysis, and other AA study-related evaluation efforts. The resulting technical information, along with stakeholder and public input, will provide the basis for the identification of a recommended transportation alternative or alternatives for the PEROW/WSAB Corridor.